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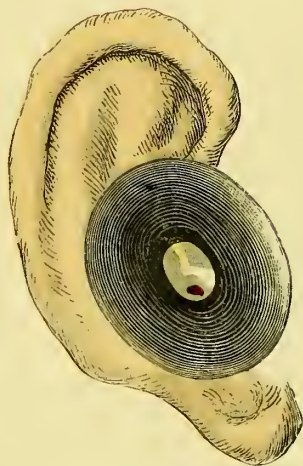
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PERFORATION OF MEMBRANA TYMPANI.

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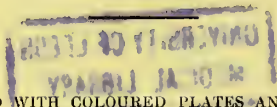
DISEASES OF THE EAR.

BY

GEORGE P. FIELD, M.R.C.S.,

AURAL SURGEON TO ST. MARY'S HOSPITAL AND LECTURER ON AURAL SURGERY IN THE
MEDICAL SCHOOL.

SECOND EDITION.

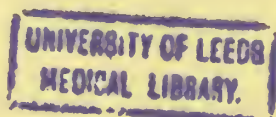


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TO

H. SPENCER SMITH, Esq., F.R.C.S.,

MEMBER OF THE COURT OF EXAMINERS OF THE ROYAL COLLEGE OF SURGEONS,
SENIOR SURGEON TO ST. MARY'S HOSPITAL,
AND LECTURER ON CLINICAL SURGERY IN ST. MARY'S HOSPITAL SCHOOL,

THIS BOOK IS DEDICATED,

AS A TOKEN OF GREAT RESPECT

AND

IN REMEMBRANCE OF MANY ACTS OF KINDNESS.



PREFACE TO THE SECOND EDITION.

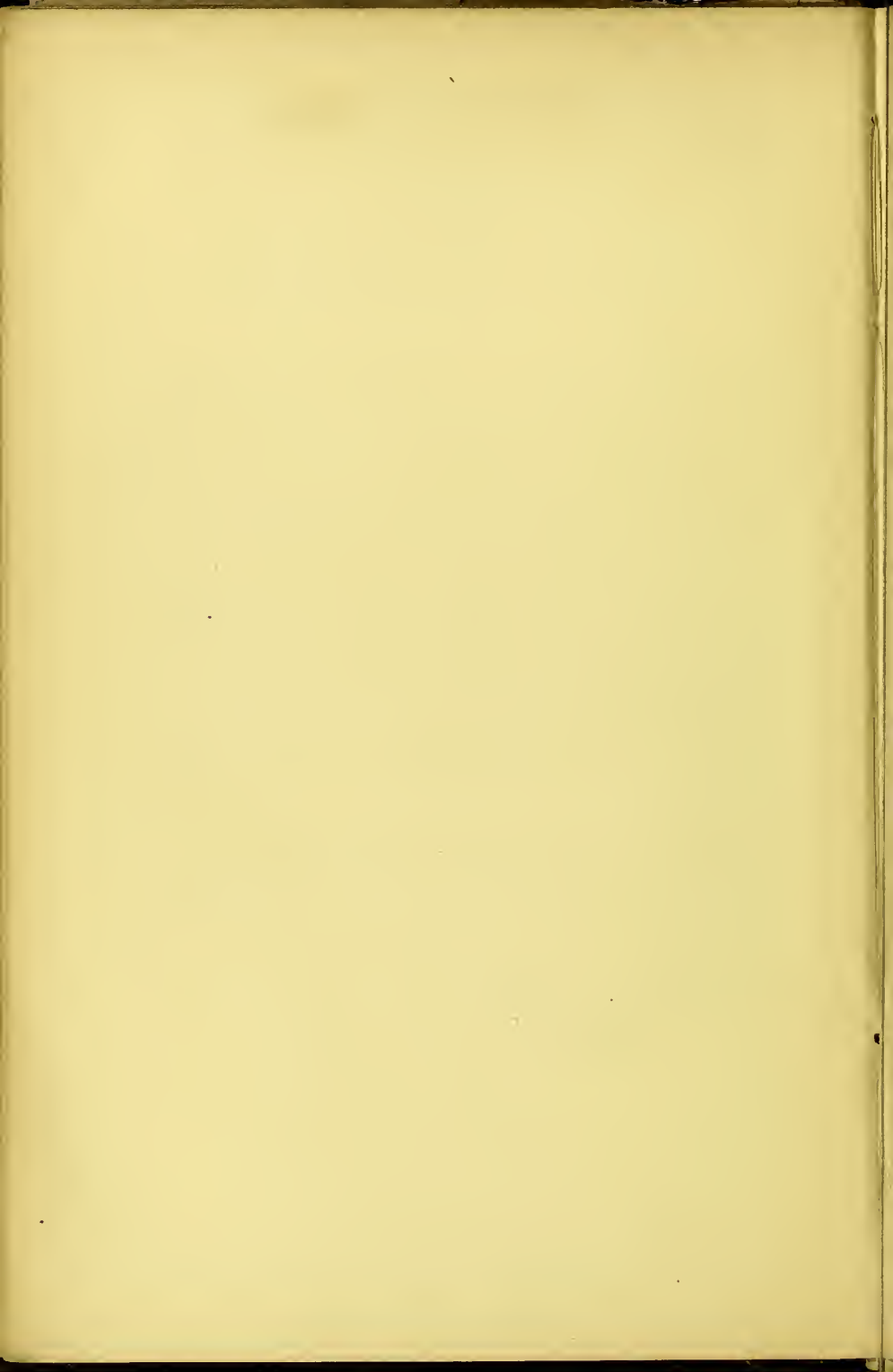
MUCH new material has been added in the second edition of this work. The rapid sale of the first edition illustrates the progress made generally in the study of, and also the demand for works on Diseases of the Ear. The writer has striven to make the present work as comprehensive as the space will permit.

His best thanks are given to the authorities to whom he refers; and also to the clinical clerks of St. Mary's Hospital for the notes of the various cases which are quoted to illustrate the different forms of ear disease.

The coloured plates and woodcuts are the work of Mr. E. Noble Smith, and the writer is much indebted to him for his faithful delineation of the different forms of disease.

It is suggested that the coloured plates of the Membrana Tympani should be looked at through an aural speculum, as by this means a more accurate conception is formed.

31, LOWER SEYMOUR STREET,
PORTMAN SQUARE,
April, 1879.



P R E F A C E.

MUCH of the substance of this work has been already published in the various Medical Journals, and I hope that it may prove of service to those Students and Practitioners of Medicine who may occasionally require a few hints when called upon to treat Aural Disease.

I have endeavoured to place before the reader, as concisely as possible, the result not only of my own experience, but also that of other Aural Surgeons, both British and Foreign, many of whom have considerably advanced the knowledge of Ear Diseases and greatly facilitated the relief and cure of deafness. To these our best thanks are due.

Great advance has been made of late years in the knowledge of Aural Diseases, and consequently in their treatment.

We can now cure or greatly relieve cases, which a few years ago were considered beyond the reach of Surgery.

The Hospital to which I belong was the first in this Metropolis to appoint an Aural Surgeon upon its Medical Staff; and the good example set by the Governors of St. Mary's was followed by most of the Medical Schools in this country.

St. Mary's Hospital numbers amongst its Aural Surgeons several men who have made great strides in the pathology and treatment of Deafness, and I

may mention my predecessors, Toynbee, Ernest Hart, and Peter Allen, as notable examples of conscientious workers in this field of Surgery.

To Mr. Hinton, under whose guidance I formerly studied this particular branch of Surgery, I here record my sincere gratitude.

I have derived material assistance from several of my colleagues.

Much care has been bestowed upon the index, so as to facilitate immediate reference.

31, LOWER SEYMOUR STREET,
PORTMAN SQUARE,
June, 1876.

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DISEASES OF THE EAR.

CHAPTER I.

ANATOMY OF THE EAR.

IN order that the practitioner may be enabled to appreciate the meaning and value of the various symptoms which spring from pathological changes in the different parts of the organ of hearing, a practical knowledge of the anatomy of the healthy ear must be premised. The relative position of adjoining and neighbouring structures must be kept constantly in view; nor must it be forgotten that areas which are apparently distant from the seat of disease, may yet be in close anatomical relationship through the medium of nervous, vascular, lymphatic, or other connection.

The following brief description of the ear, whilst laying no claim to scientific merit, may yet be of value in recalling, or suggesting certain anatomical details to some few of those who may not be disinclined to dip further into the pages on "Diseases of the Ear."

The organ of hearing consists of three distinct parts, named from their relative position, external, middle, and internal ear.

THE EXTERNAL EAR.

The external ear commences in the expanded pinna, which consists of yellow cartilage enclosed within delicate skin. By this trumpet-shaped expansion many, but by no means all, of the sound-waves are collected, to be conducted by the column of air occupying the external meatus down to the parchment of the drum (middle ear), the *membrana tympani*.

Darwin considers that the whole of this external shell is merely rudimentary in man, as are also the various folds and prominences which in the lower animals strengthen and support the ear. ("Descent of Man.") The late Mr. Toynbee, also, after considerable investigation, held the same opinion, and in a case of rodent ulcer for which my colleague, Mr. Edmund Owen, lately removed the whole of the pinna, the sense of hearing did not appear to be in the least diminished by the operation.

The intrinsic and extrinsic muscular bands in connection with the human ear are, beyond all doubt, but rudimentary; though persons are occasionally found in whom the power of moving the pinna persists. It is an interesting fact, that the more nearly the shape of the ear of the *quadrumanus* approaches that of man, the less developed do these proper muscles become.

From an error or arrest in the development of the human ear, the pointed pinna now and then, though rarely, recurs. The appearance thus presented is highly suggestive of the existence of a certain, though perhaps distant relationship, at any rate as regards development, between man and the ape.

The margin of the pinna is called the helix; it "obviously consists of the extreme margin of the ear

folded inwards," whilst the small pointed projection which is tilted forwards from it, represents the apex of the ear of certain lower animals (Darwin). This little blunt point stands strangely outwards in certain men, and was curled upwards and forwards in those statues in which the ancients gave us their idea of the fabulous sylvan deities.

The skin of the external ear, though thin, is so closely connected with the cartilaginous framework that abscesses beneath it are usually small and closely circumscribed; and a cut through the pinna heals but slowly on account of the presence of the cartilage. The lobule, the most dependent part of the external ear, contains no cartilage: it is made of skin and connective tissue, and is but poorly supplied with nerves. The old-fashioned advice to pierce the lobule and insert an ear-ring for the cure of weak eyes (chronic ophthalmia), probably had its origin in the fact that counter-irritation so near to the orbit relieves, in some derivative way, the conjunctival congestion.

Short thick hairs at the entrance of the external auditory meatus guard it somewhat against intrusive insects. The wax secreted by the glands of the canal-wall keep the integument from drying and chapping.

The delicate skin between the pinna and the mastoid process is frequently the seat (especially in children) of intertrigo or eczema. The latter condition not infrequently gives rise to enlargement of the lymphatic gland over the mastoid process. The presence of this lymphatic gland should be borne in mind: it is often the seat of abscess from impetigo capitis. It may also take on a chronic enlargement, like the glands under the sterno-mastoid, or, indeed, in any other region.

A small branch of the pneumogastric nerve (Arnold's) is here distributed. This is the twig which the alderman stimulates after dinner with the corner of his napkin dipped in cold water; and so the stomach hurries on the digestive process with renewed attempts at energy.

The external auditory meatus is about three-quarters of an inch long, and starting from the depths of the pinna (concha) between the condyle of the jaw and the mastoid process, passes at first a little upwards and then slightly downwards, until it reaches the tympanic membrane. The main course of the canal is like that of the petrous portion of the temporal bone itself, forwards and inwards. Like an hour glass, it is somewhat smaller at the middle than at either end; so that though a cherry-stone or a pea may lie loose at its inner end, the surgeon may experience considerable difficulty in getting it back through the straits. The cul-de-sac being considerably larger than the cherry-stone or pea, the foreign body will lie loosely, and will not set up nearly as much inflammation as if it were tightly jammed at the bottom of the meatus.

The external meatus is not made entirely of bone, for the cartilage of the pinna runs into it, and the pinna must be drawn well upwards and a little outwards, if the observer is desirous of obtaining a good view of the depths of the canal.

The bony part of the meatus is developed from a separate centre of ossification—the tympanic bone—which appears on the foetus as a delicate osseous horse-shoe with the gap looking upwards. Within this ring as the frame, the tympanic membrane is stretched.

The meatus is lined with a layer of true skin and epidermis; the former frequently suffers from a chronic

inflammation which causes it to become thickened and to secrete much wax, and also to proliferate epidermal scales to excess. Thus the canal becomes narrowed and often plugged.

Erysipelas of the meatus may spread by continuity of tissue to the middle ear, and even to the membranes of the brain.

We remarked above that the external auditory meatus runs in front of the mastoid process, and it must be remembered that the purulent discharge in otorrhœa may be derived from suppuration going on in the neighbouring (mastoid) cells,—a very grave condition.

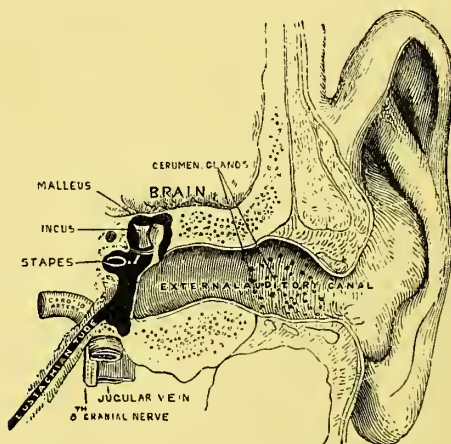
The tympanic membrane slants downwards and forwards at the bottom of the external auditory meatus. When healthy it is pearly-white, and so translucent that the handle of the hammer (malleus) may be seen running downwards and backwards across its inner surface. Dragged inwards by the hammer, the membrane is concave on the outer surface, and convex on the tympanic side. It is composed of three layers, of which the middle is the strongest, being made of radiating and other fibres. The outer layer is derived from the epidermis which lines the meatus throughout. Post-mortem soaking of the ear enables the dissector to remove the whole of the epidermis (including that from the membrane) like the finger of a glove. The other side of the membrane is covered by the delicate mucous membrane which lines the middle ear.

The membrane derives a small arterial supply from the vessels of the meatus, but two twigs run into the inner surface along the handle of the hammer; these are derived from the stylo-mastoid branch of the posterior auricular, or from some other tympanic artery.

A clean cut through the membrane does not gape, the tissue being but slightly elastic. Tillaux truly says that nothing is more difficult than to close a spontaneous rent in it, nor to keep patent a surgical wound made, for instance, with the view of insuring a free exit of pus.

THE MIDDLE EAR.

The tympanum or middle ear is a small air-chamber excavated in the substance of the petrous portion of the temporal bone, and ventilated from the pharynx by the Eustachian tube. It is situated between the membrane and the internal ear, and measures about a quarter of an inch across. It is rather larger in the antero-posterior measurement, and it communicates behind with the air-cells in the mastoid process. In front of it ascends the internal carotid artery, separated from the cavity by a thin layer of bone only. From the front the Eustachian tube and the tensor tympani enter.



TRANSVERSE SECTION OF THE EAR (LEFT SIDE).

The roof the tympanum is formed of an extremely thin layer of bone which separates it from the cranial cavity. From it descend delicate ligaments to suspend the two outer of the chain of bones (hammer and anvil). So close to the tympanum are the brain and its membranes, that encephalitis not unfrequently follows an abscess of the middle ear.

The floor of the cavity is composed of a layer of bone which roofs-in the jugular fossa.

Thus the six sides of the middle ear are found to possess relations of the greatest importance, both to the anatomist and the surgeon; fractures of the base of the skull, extending through the tympanic cavity, may rend the internal carotid artery, or the internal jugular vein, and so give rise to fatal hæmorrhage from the external ear; or caries, the result of an inflammation, may cause the same disaster. Again, an otitis may be followed by an inflammation of the jugular vein, which may give rise to a fatal thrombosis; or the pathological condition may spread to the eighth pair of nerves (glosso-pharyngeal, pneumogastric, and spinal accessory) which pass through the jugular foramen, and implicate them and the regions to which they are distributed, in a series of otherwise unaccountable symptoms.

Taking advantage of the superficial situation of the mastoid air-cells, and of their communication with the middle ear, surgeons used formerly to make an opening into them, from behind the pinna, in those cases of deafness which were supposed to result from a permanent blocking of the Eustachian tube. But in one well-known instance this seemingly slight operation was followed by fatal meningitis; so, as Mr. Holden says, "the death of this illustrious man brought the operation into disrepute."

On the dry bone may be seen, just behind the mastoid process, a good-sized foramen which transmits a vein from that region of the scalp directly into the lateral sinus. It is well known that leeches applied behind the ear may give great relief in congestion, or inflammation of the ear, or of the brain.

The middle ear is lined with a firm but delicate mucous membrane which, having surrounded the chain of ossicles, and having given the third layer to the tympanic membrane, passes backwards to carpet the mastoid cells, and forwards to line the Eustachian tube. Being thus continuous with the lining of the throat, a ready explanation is offered in the case of otitis following on an inflammation of the pharynx. The epithelium is squamous (Kölliker) and ciliated; but it is said that cilia are not found in that part of the mucous lining which covers the tympanic membrane.

THE EUSTACHIAN TUBE.

The Eustachian tube is about an inch and a-half long, and runs forwards and inwards from the junction of the squamous and petrous portions of the temporal bone to the pharynx, where it ends by a wide, trumpet-shaped aperture on a level with, and just behind, the soft palate. The cartilaginous opening is easily found on the side of the pharynx by a properly curved catheter introduced along the inferior meatus of the nose. The bony part of the tube lies just below the canal for the tensor-tympani muscle, and passes along the outer side of the internal carotid artery.

Having thus shortly described the central position and connections of the middle chamber of the ear, we must now proceed to examine it and its contents more

in detail; and for this purpose it will be well to commence with an account of

THE TYMPANIC OSSICLES.

These three small bones are swung as a short chain across the cavity from the outer to the inner wall. They are happily named, from their configuration, the hammer, the anvil, and stirrup; by their oscillation they transmit the vibrations of the tympanic membrane to the fluid in the internal ear. As we have already noticed, the mucous membrane of the tympanum is wrapped around the chain, and it provides each segment with its periosteal covering, and also furnishes it with its nervous and vascular supply.



The hammer-bone (malleus) has a head, handle, and two processes. The head is rounded, and presents a smooth depression for articulation with the crown of the anvil; the connection between these bones is secured by a delicate capsular ligament, and is lubricated by a synovial membrane. The handle is curved like an italic *f*, and lies embedded, between the inner and middle layers of the tympanic membrane, in the upper and anterior part of the circle. The long and slender process runs downwards and forwards, from near where the handle joins the head of the hammer, to lose itself in the Glaserian fissure. [It is generally broken by the dissector in his attempt to remove the bone.] It receives

the insertion of the laxator tympani, often described as a small muscle, but which is probably merely a ligamentous band, which is attached to the spine of the sphenoid bone.

Wharton Jones admits only two muscles in connection with the tympanic ossicles, both tensors of the membrane; one the special tensor tympani, the other the stapedius.

The former muscle arises in the bony canal in which it is lodged, and from the exterior of the Eustachian tube, and passing into the front of the middle ear, its tendon bends suddenly outwards around a spoon-shaped piece of bone (processus cochleariformis), to be inserted near the root of the handle of the hammer. Dragging the hammer inwards, and with it the membrane, it renders the last-named structure more convex. It is supplied by a branch of nerve from the otic ganglion.

The anvil-bone (incus) has a body, with the surface of which articulates the head of the hammer (the opposed aspects being coated with cartilage), and two processes; of these the shorter runs horizontally backwards into an aperture in the mastoid cells, and is there fixed by a ligament. The "long" process passes downwards almost in the direction of the handle of the hammer, and ends in a minute button, "os lenticulare," which articulates with the head of the stirrup by a capsule and synovial membrane.



LEFT MEMBRANA TYMPANI AS SEEN FROM THE INNER AND OUTER SIDE RESPECTIVELY
(AFTER QUAIN).

The stapes is exactly like a stirrup. Its head is connected with the tip of the long process of the incus; and from it the crura, or arms, pass down to an oval plate of bone, which nearly fills up a similarly shaped aperture (fenestra ovalis) on the inner wall of the tympanum. On the other side of the foot-plate of the stirrup is the water of the internal ear, or labyrinth.

Thus we have traced the connection between the tympanic membrane and the fluid in the internal ear through the oscillating chain of bones. The presence of the hammer and the anvil, however, are not essential to the sense of hearing. They may be torn out by the unskilful manipulator in his rough attempts to remove a foreign body from the external ear; or they may be carried away in the purulent discharge of a tympanic abscess, and yet the hearing may persist. But if the stapes is displaced, the fluid of the internal ear drains away into the tympanum through the fenestra ovalis, leaving the delicate expansion of the auditory nerve as useless as a bucket in a dry well.

A small muscle, the stapedius, arises in a hollow pyramidal process at the back of the tympanum, and passing forwards is inserted into the head of the stapes. It probably compresses the fluid in the internal ear, whilst it renders tense the tympanic membrane. It is supplied by a branch of the facial nerve.

Now turning our attention to the bony wall which separates the tympanum from the internal ear, we notice upon it an elevation, the promontory caused by the bulging outwards of the first turn of the cochlea, a part of the internal ear. Above it, on the dry bone, is the small oval opening—fenestra ovalis—which is blocked by the base of the stirrup. It opens into that

part of the internal ear which is called the vestibule. Below and behind the promontory is another opening, the fenestra rotunda, which looks into the cochlea; as there is no process of bone from any of the ossicles to block up this round window, it is glazed by a thin (secondary) membrane.

It is by these two apertures that the waves of sound are transmitted from the middle to the inner ear; but whether they pass through the round or oval window is still a disputed point. If by the oval only, of what use is the round window? Probably the vibrations propagated by the stapes set the water of the internal ear in quivering movement, and increased pressure finds vent by pushing outwards with synchronous throbs the pliable tissue blocking up the round window.

Upon the promontory are fine grooves for the filaments of the tympanic plexus, a delicate interlacement between a branch of the glosso-pharyngeal nerve (Jacobson's) with sympathetic twigs derived from the *nervi molles* on the neighbouring internal carotid artery. One branch of the tympanic plexus eventually reaches the otic ganglion.

Above the oval foramen is a ridge which marks the course of the subjacent facial nerve in the aqueduct of Fallopius (see page 115). Just before the nerve leaves the lower aperture of the bony canal (stylo-mastoid foramen) it gives off a slender, thread-like branch (*chorda tympani*), which, entering the back of the middle ear by a small foramen, passes across the tympanic membrane to an aperture near the Glaserian fissure, through which it courses on to join the gustatory nerve. As it runs through the tympanum it is situated between the handle

of the hammer and the long process of the anvil, and it is wrapped up in a fold of the mucous membrane of the middle ear. Leaving the gustatory nerve the chorda tympani afterwards ends in the submaxillary ganglion, and in the supply of the intrinsic muscle of the tongue (lingualis).

Of the blood-vessels of the tympanum but little need be said; the arteries are small twigs derived from the internal carotid, the internal maxillary, the stylo-mastoid, and the middle meningeal. The veins terminate in the middle meningeal trunk, and in other neighbouring vessels.

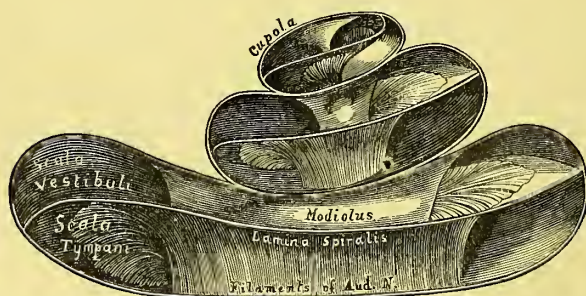
The internal ear is a labyrinth tunnelled out in the petrous portion of the temporal bone, and is situated at the bottom of the internal auditory meatus. It consists of three parts, the cochlea, the vestibule, and the semicircular canals, in that order from before backwards. On the outer side it communicates with the tympanic cavity (in the dry bone) through the round and oval foramina. The vestibule (situated in the middle) communicates with the cochlea in front by the *apertura scalæ vestibuli*, and with the semicircular canals behind. It is about $\frac{1}{5}$ of an inch in each measurement. Small foramina are found on its inner wall, which transmit twigs of the auditory nerve into the vestibule from the bottom of the internal auditory meatus. These minute perforations are situated in a small round pit, which is called the *fovea hemispherica*. On the roof of the vestibule is another slight excavation, the *fovea hemielliptica*.

The semicircular canals, three in number, are hard-walled, osseous tubes, situated in the petrous bone. They are shaped like horse-shoes, and open by each end into the back of the vestibule. They are arranged at

right angles to each other: just as the floor, the end, and the adjoining side of a box are at right angles to each other.

The superior canal ascends in the antero-posterior plane to such an extent as to cause a bulging on the upper surface of the petrous bone in the middle cranial fossa. The posterior also rises vertically, and, as it occupies the transverse plane, it runs at right angles to the superior. The external canal lies in the depths between the others, and passing outwards lies horizontally; it is the shortest of the three. Now, as these horse-shoe tubes all open into the vestibule, we should expect to find six small apertures; but there are only five of them, because the superior and posterior canals have their adjoining ends merged into a common opening.

One end of each canal is dilated into an "ampulla," the word being derived from the big-bellied jug in which the Romans kept wine.



THE COCHLEA LAID OPEN (ENLARGED).
(AFTER GRAY.)

The cochlea is well named from its resemblance to a snail-shell; it is placed horizontally in front of the vestibule, its base lying against the bottom of the

internal auditory meatus. Examining it in detail, it is found to consist of a central axis, modiolus, around which a tubular canal takes two turns and a half, diminishing as it ascends. (Modiolus, diminutive of modius, a Roman dry measure, was the nave of the wheel.) The axis is large and conical, and contains filaments of the auditory nerve, which it has received from the bottom of the internal meatus. But the nerves do not ascend further than the level of the second turn, for there the axis becomes very slender, and, expanding like a funnel, loses itself in the tip of the cochlea. A slender spiral shelf (*lamina spiralis*) runs from the axis half-way across the tube; and from the lower border of its peripheral margin a delicate fibrous layer, *membrana basilaris*, is continued on to the outer wall of the cochlea. Thus the spiral tube is divided into two galleries, an upper and a lower, of which the latter (in the dry bone) opens into the tympanum by the *fenestra rotunda*; whilst the former, even in the living subject, communicates with the vestibule by the *apertura scalæ vestibuli*, which we have noticed above. As the *lamina spiralis* does not pass into the last half-turn of the cochlear tube, the tympanic and vestibular galleries there communicate; the space where they join is called the *helicotrema* (*ἑλιξ*, *ἑλικος*, coil; *τρημα*, perforation).

The bony part of the *lamina spiralis* consists of two thin plates, between which pass minute blood-vessels, as well as filaments of the auditory nerve; and, just as the basilar membrane passes from the lower of these plates to the outer wall of the cochlea, so from the upper plate is stretched the membrane of Corti. Between these two delicate membranes is placed the organ of Corti, which

consists of strangely-shaped epithelial cells and rods in communication with the cochlear filaments of the auditory nerve. The rods of Corti, standing upon the inner and outer margins of the basilar membrane, slant towards each other above, and their heads meeting, leave an arched passage, or avenue, along the middle of the membrane.

On the outside of the avenue, resting upon the basilar membrane, are rows of cells, whose heads are covered with stiff cilia. There is one row of hair-cells on the inner side of the rods of Corti, and three or four on the outer side. Possibly the feet of the cells are prolonged deeply until they come in contact with the ending of a filament of the auditory nerve, in the same way that the olfactorial cells, described by Schultze, dipping down into the Schneiderian membrane, are supposed to join with the filaments of the olfactory nerve.

The vestibular scala is subdivided by the membrane of Reissner, which stretches from the upper layer of the lamina spiralis to the outer wall of the cochlea. This small additional gallery thus lies between the membranes of Corti and Reissner; it is called the canal of the cochlea. Ellis describes it as closed above near the tip of the cochlea, and as communicating below by a very small tube with the cavity of the saccule, a small, bladder-like body, which is lodged in the fovea hemispherica of the vestibule.

The vestibule is lined throughout by a delicate fibrous tissue, which is by one surface in firm connection with the bony wall, whilst on the other it is covered with a layer of cells of squamous epithelium. It is this membrane which closes in, with the help of the base of the stapes, the foramen ovale. From the vestibule the

lining is continued throughout the semicircular canals, whilst it enters the uppermost gallery of the cochlea (*scala vestibuli*) through the *apertura scalæ*. This gallery it lines throughout, up to the very top, and thence it passes through the gap left by the ending of the *lamina spiralis* (*heliocotrema*) into the lower gallery, the *scala tympani*. At the bottom of this *scala* it ends, blocking up the *fenestra rotunda*. So the osseous labyrinth is lined throughout with a fibro-serous membrane. The office of the membrane is to secrete a watery fluid, the *perilymph*.

The *perilymph* of the vestibule has floating in it a bladder, which is several sizes smaller than the bony chamber itself, and tubular prolongations run backwards from it through the horse-shoe canals. These prolongations swell out in the *ampullæ*. From their being so like the osseous labyrinth in shape, the bladder and its semicircular processes are called the membranous labyrinth. It is covered on its inner side throughout by a layer of squamous epithelium, which secretes more watery fluid, the *endolymph*. This fluid finds its way into the canal of the cochlea (the middle gallery) by a small tubular duct, named by Hensen "*canalis reuniens*."

Thus the upper and lower galleries contain *perilymph*, whilst the intermediate one contains *endolymph*.

A small channel leads out of the cochlea, and another out of the vestibule; but although they are called the "*aqueducts*" of these cavities their probable function is the transmission of slender blood-vessels.

That part of the membranous labyrinth which

occupies the vestibule bulges out into two cystic swellings, the utricle and saccule. The former of these is the higher and larger, and receives the openings of the semicircular canals; it is lodged in the depression known as the fovea hemielliptica. The saccule is the rounded dilatation which occupies the fovea hemispherica; it is connected with the canal of the cochlea by the ductus reuniens.

On the inner wall of the utricle and saccule, and suspended in the endolymph, are two small hard masses composed of crystals of carbonate of lime. Todd and Bowman describe similar ear-stones (otoliths) in the ampullary dilatation of the semicircular (membranous) canals, but Wharton Jones, however, denies their presence both in man and in the lower animals. The otoliths, like those hair-cells which line the ampullæ, and enter into the formation of the organ of Corti, play almost a mechanical part in the physiology of hearing.

THE AUDITORY NERVE.

The auditory nerve (portio mollis of seventh pair) on reaching the bottom of the internal auditory meatus divides into two branches, one for the cochlea, the other for the vestibule. The cochlear division is, of course, the anterior; its filaments enter the foramina at the base of the modiolus, and thence bend out at right angles into the bony shelf, the lamina spiralis. Here, according to Ellis, they form a plexus with ganglion cells, and thus reach the edge of the spiral lamina, and terminate in connection with the cells in the organ of Corti (Kölliker).

The vestibular portion of the nerve passes through a

foramen at the bottom of the internal auditory meatus, to be distributed on the utricle and saccule, and upon the ampullary dilatations of the membranous canals. The ultimate fibres pierce the wall of the membranous labyrinth, and are probably distributed in the form of a fine network upon the internal surface. The twigs in the utricle and saccule are brought into close connection with the calcareous particles of the otoliths.

The arteries of the labyrinth are derived from the auditory branch of the basilar, the stylo-mastoid of the posterior auricular, and occasionally from the occipital. The cochlear twigs of the auditory artery run with the nerve filaments up the axis.

The veins of the labyrinth end in some one or more of the neighbouring sinuses.

CHAPTER II.

THE PHYSIOLOGY OF HEARING.

A CLOSE analogy exists betwixt the allied organs of sight and hearing, both as regards their structure and function.

The eye consists of a firm envelope, the sclerotic, on the interior of which are spread out the terminal filaments and ganglionic cells of the optic nerve. The essential part of the ear consists of a hard cavern, the bony labyrinth, in the interior of which are arranged the filaments and ganglionic cells of the auditory nerve. In each case the elements of the sensory nerve are so arranged as to be most perfectly exposed to that kind of irritation which is best adapted for the due liberation and propagation of the molecular changes to the central organ. Herbert Spencer remarks, "Every agent capable of altering the molecular state of a nerve, causes the nerve to produce the particular change which it habitually produces."

The nerve-disturbance in the essential part of the organ of hearing is caused by the vibrations of the labyrinthine fluid acting upon the auditory cells and filaments, and these vibrations are generally brought from the external air through a chain of ossicles which communicate, by either end, with the tympanic membrane and the internal ear. The nerve-disturbance may also be set up by the pressure of mucus or pus in the cavity of the middle ear, or by the increased supply of blood

in inflammation; but the pressure so caused gives rise to the transmission of some of those meaningless molecular changes which are appreciated as "rumblings" and "singing" in the ears. The ganglionic cells in connection with the termination of the auditory nerve, being formed of unstable protein substance and fat granules, undergo at every stimulation a certain amount of molecular decomposition; the result of this decomposition is the liberation of motion, which produces an isomeric transformation along the more stable protein substance of the axis band of the auditory filament. This nervous stimulation and discharge is well described as consisting of waves of molecular change, that chase one another rapidly through nerve fibres; the stimulus or discharge formed of such waves arising at some place where unstable nerve substance has been disturbed (data of psychology).

In the case of the auditory nerve the stimulation and discharges are specially provided for in two ways:—first, by the disturbances of the stiff process of the fibres of Corti, and the hair-cells of the cochlea and ampullæ; and secondly, by the concussion of the otoliths suspended in the endolymph of the utricle and the saccule. It is by no means certain that the ultimate filaments of the auditory nerve come into immediate contact with the bases of the hair-cells. Some of the latest observers are of opinion that the connection is made through the medium of a mesh of protoplasmic film; but as regards the otoliths, there can be but little doubt that a direct nervous stimulation and discharge follow upon their coming in contact with the vestibular filaments of the nerve. Huxley, indeed, compares their effect upon the auditory filaments to that produced upon the sensory

network of the skin of the bather by the pelting of the showers of little stones and sand, which are raised and let fall by each wavelet which rolls upon the sandy beach. But the auditory nervous network is infinitely more complex and delicate than that of the skin ; and is, therefore, more prone to disintegration, resulting in the discharge of isomeric changes of the utmost complexity. Thus we are able to appreciate not only the force of sounds, but their loudness, pitch, quality, and direction. So various and subtle are the changes which the stimulation of the nerve elements produces that they are far beyond the reach of material investigation. We merely express the result of these changes in speaking of the loudness, pitch, quality, and direction of sounds. It must be borne in mind that the auditory filaments do not reach the hair-cells or the otoliths upon a firm bed ; but having traversed the perilymph, they gain these intensifying agents as they project into the endolymph of cochlea, the ampullæ, and the vestibule. It may be inferred that the vibrations in the endolymph are much more delicate than those of the perilymph which give rise to them, and that the vibrations of the perilymph are finer than the oscillations of the auditory ossicles ; whilst simplest of all will be the movements of the tympanic membrane. By the time, then, that the air-waves have reached the ultimate distribution of the auditory nerve, the vibrations have become infinitely modified, subtle, and delicate. It is fortunate, as Michael Foster remarks, that the membrane has no marked note of its own, for that if it had a fundamental note of its own it would be continually asserting itself with other sounds heard. By no means all the vibrations which reach the auditory nerve are transmitted

by the chain of bones; some pass directly across the middle ear, and reach the perilymph in the cochlea by means of the membrane blocking up the fenestra rotunda, whilst other vibrations may reach the sentient twigs through the bony wall of the skull and of the labyrinth. These are probably received by the cochlea and ampullæ.

A glance at the arrangement of the tympanic ossicles shows how, when the tympanic membrane is thrown into vibration, the handle of the hammer moves with it, whilst the head of the bone, pressing upon the base of the anvil directs the long process of the last-named bone against the apex of the stirrup, and the base against the membrane which assists in filling up the fenestra ovalis. So small are the bones and their joints, that pathological anatomy has not yet thrown much light upon their precise physiological office: but certain it is that the stirrup (stapes) is the most important element. The hammer (malleus) and the anvil (incus) have been extracted in careless manipulation, and the sense of hearing has remained. Tympanic abscess also may cause these two bones to be loosened and thrown out; but if the stapes remains, hearing may still not be destroyed. But if the last-named bone becomes dislocated, deafness on that side is inevitable, on account of the escape of the perilymph through the foramen ovale. But the connection of the stapes with the margin of the fenestra ovalis is particularly firm, so that though the malleus and incus may be loosened and discharged, still the oval foramen remains watertight. Chronic catarrh of the tympanum, as will be shown hereafter, will, by causing a thickening of the mucous membrane, prevent the oscillatory movements of the bones; and thus by

fixing the base of the stapes may cause permanent deafness.

The labours of Helmholtz have resulted in several hypotheses concerning the special function of each element of the essential part of the organ of hearing. Thus the nerve filaments spread out in the membranous vestibule and ampullæ are supposed to watch over the perception of those vibrations of irregular periodicity which we call noise: whilst the cochlear fibres are stimulated by the periodic vibrations of musical sounds: the semicircular canals being supposed to appreciate the direction whence a sound proceeds. That the vestibule is the most essential part of the labyrinth may be presumed from the fact that in some of the lower animals no other trace of an auditory apparatus exists. According to Huxley, the vestibular nerve tells us that sounds are weak or loud; but gives us no further impression of tone, or melody, or harmony. The even and regular distribution of the multitudinous fibres of the cochlear branch of the auditory nerve, and their probable connection with the fibres and hair-cells of the lamina spiralis, which latter bodies are placed with equal regularity, has induced speculative physiologists to draw an analogy between the organ of Corti and the wires and keys of a piano, and to consider that each cell and each filament will answer to its proper note. Michael Foster gives a pretty physical illustration of this hypothesis: he says, "If a person standing before an open piano sings out any note, it will be observed that a number of the strings of the piano will be thrown into vibration, and on examination it will be found that those strings which are thus set going correspond in pitch to the fundamental tone and to the several over-

tones of the note sung." Further on he remarks that the arrangement of structures in the organ of Corti offer an "irresistible suggestion." Concerning the function of the semicircular canals many theories and speculations have been advanced, but as yet the exact office of those filaments of the *portio mollis* which are distributed upon their membranous ampullory enlargements is not with any certainty known. Much experimentation in the way of vivisection has been performed on the canals; and one and all have been divided with tolerably constant results. One of the most important and significant being this, that though the canals may be destroyed, still the animal seems perfectly happy, feeding as usual, whilst it appears to be as keen to the perception of sound as ever. Have, then, the ampullory fibres of the nerve any auditory function? Ferrier, quoting Flourens' experiments, remarks that strange disturbances of equilibrium followed sections of the membranous canals, and that when the external (horizontal) one was divided the animal moved its head from side to side; that when the posterior was divided the animal moved its head backwards and forwards, and tried to turn summersaults backwards; and that when the superior was injured it tried to turn over forwards. These experiments have been confirmed by the researches of Crum Brown.

Goltz regards the semicircular canals as the origin of impressions which regulate the equilibrium of the head and with it the whole body (Ferrier in *West Riding Reports*). Ménière was the first to connect a special set of symptoms with a pathological condition of the semicircular canals; but Ferrier remarked that a subject of Ménière's disease retained the power of testing

notes struck on the piano with more acuteness in the affected ear than in the other. Evidence, then, is somewhat against the existence of any special auditory function in the ampullory fibres. The position of the canals, however, has led many physiologists to consider them as determining the direction from which a sound proceeds, but our power of determining the direction of a bell, ringing in a fog for instance, is extremely limited; and were it not for our knowledge of locality and appreciation of space being brought to bear on the solution of such a problem, our ability to make a correct estimate would probably be most imperfect. Professor Gamgee remarks that Cyon considers the semicircular canals to be the peripheral organs of the sense of space; and that the agitation of the epithelial processes of the ampullæ either by movement of the head, or by waves propagated through the endolymph, is the proximate cause of the stimulation of the ampullory nerves. The same authority rejects the auditory function of the ampullory nerves.

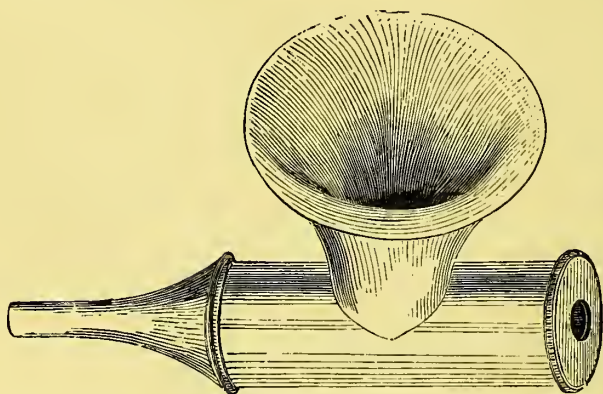
The Eustachian tube is the canal by which the air in the middle ear is received from the pharynx; when the canal becomes blocked, as in catarrhal inflammation, or from the pressure of a tumour, the equilibrium of the air on the two sides of the tympanic membrane becomes so disturbed that the vibrations of the membrane are imperfectly performed, these form common causes of deafness. Another use for the tube is a drain for the mucus which would otherwise block up the middle ear. Lastly, the Eustachian tube plays a part analogous to that of the mastoid cells in allowing the escape of the superfluous sonorous undulations, which would not impinge upon the labyrinthine wall;

and in this way the birth of an echo in the middle ear is obviated (R. B. Todd). Though the pharyngeal end of the Eustachian tube is cartilaginous, still it is not always open. In all probability it is always shut except during the latest stage of deglutition. There arises from the wall of the tube as well as from the seaphoid fossa of the sphenoid bone, the tensor palati muscle, which, turning round the hamular process of the internal pterygoid plate, is inserted into the substance of the soft palate. Now, when the soft palate is firmly fixed during deglutition and the muscle is contracting, the lower wall of the tube is depressed, and air passes into or out of the tympanum according as the pressure is greater or less on the outside of the tympanic cavity. This explains the necessity of making the patient swallow when the surgeon is treating a temporary obstruction of the tube by Pollitzer's method.

CHAPTER III.

EXAMINATION OF THE PATIENT.

THE thorough examination of a patient with deafness is not quite such a simple process as it may at first sight appear; a fact which is exemplified by the frequency of errors in diagnosis, and consequent want of success in treatment, on the part of those surgeons who have not commenced the work in the right way. It is well to remember that the external auditory meatus is larger in its vertical diameter in the adult; whereas in children the reverse is the case, the horizontal diameter being the greater in them. The ear speculum is an auxiliary of great value.



BRUNTON'S OTOSCOPE.

Brunton's instrument is by far the best for ordinary

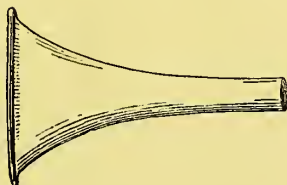
purposes, and its advantages as given by the inventor, are :—

1. That it is simple in construction.
2. Is easy of application, a few trials being sufficient to make the observer expert.
3. It enables the ear to be examined with precision and minuteness.
4. It can be used either with sun or artificial light.
5. It can be used with the magnifying power or not, at pleasure.



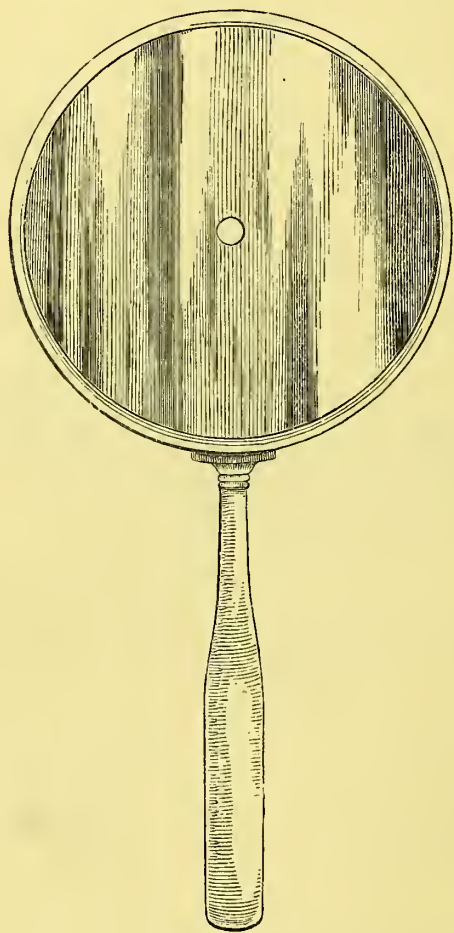
BRUNTON'S METHOD OF EXAMINING THE MEMBRANA TYMPANI.

The ordinary silver ear speculum also answers very well when a concave mirror is used.

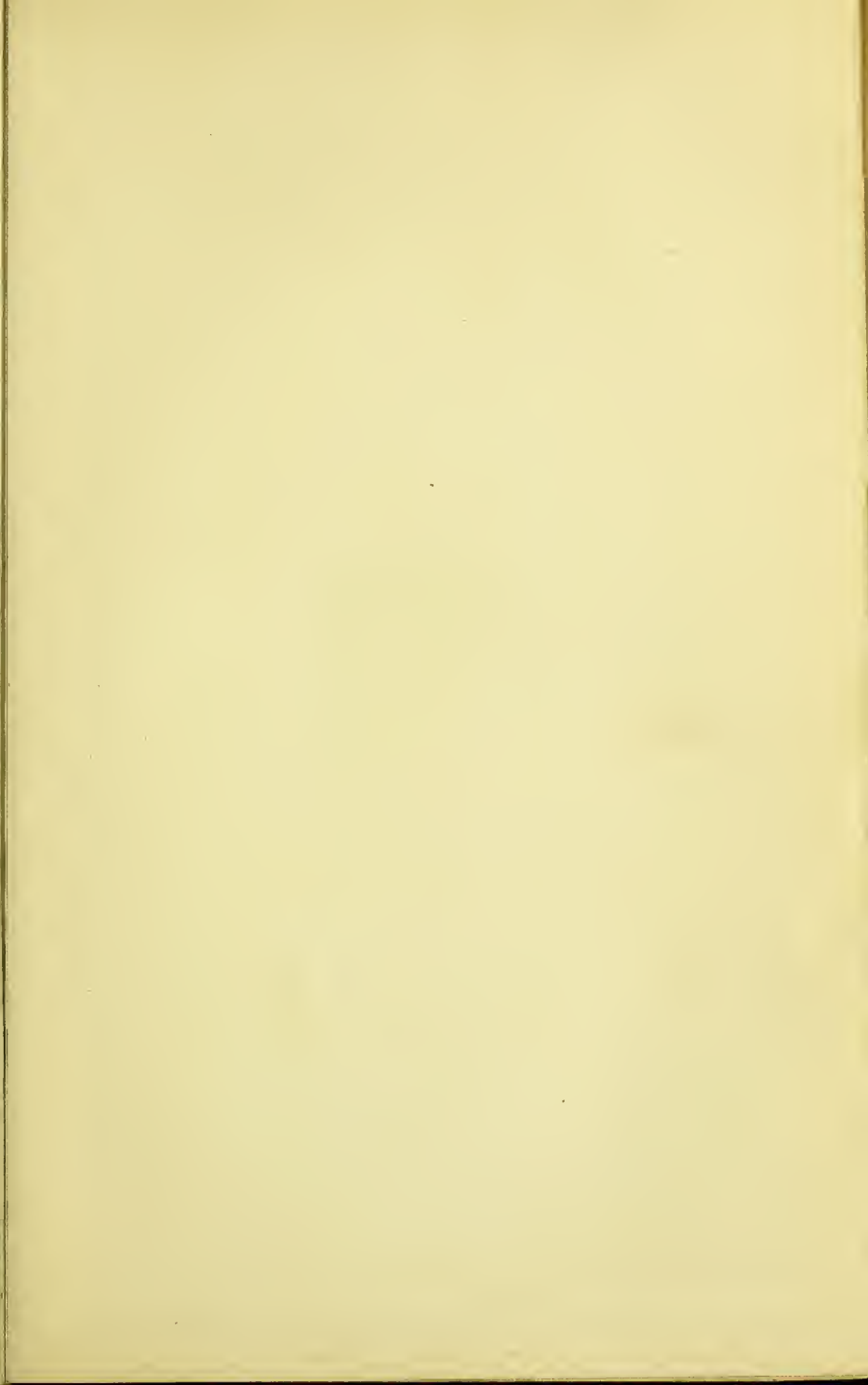


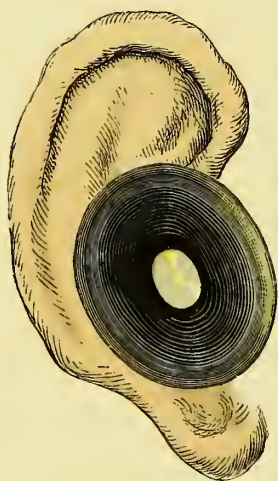
More elaborate instruments have lately been intro-

duced, such as those suggested by Weber-Liel and Keene; and still further improvements, I think, we may anticipate from the use of the electric light.



HAND MIRROR.





THE MEMBRANA TYMPANI.

(As seen through the Speculum.)

These, then, are the means we command for looking at the membrana tympani; and next it is essential that it should be known what the healthy membrane is like. Suffice it here to say, that it is a thin, delicate membrane of a pearly-grey colour, presenting a bright spot of triangular shape at its lower and anterior portion at the end of the long process of the malleus. Constant practice alone will enable an observer to become familiar with the variations in colour, shape, &c.

The next most important point is to find out the exact hearing distance, and the best way of doing this is to bring a watch gradually towards the ear; and not to first place it near and then withdraw it. A note of the hearing distance should always be made, so that the next time the patient is seen the surgeon may judge as to the improvement made, &c.

There are other instruments recommended for testing the hearing power, such as the metronome, and Professor Politzer has lately introduced his Hörmesser, which produces a sound, or sharp click, of uniform character.

By the use of the tuning fork as a means of diagnosis we are enabled at once to distinguish between the diseases dependent on affections of the nervous and those of the conducting apparatus of the ear: say those of its external and middle divisions, which are the conducting apparatus, from those of the auditory nerve; *i.e.*, of the sound-conducting from the sound-perceiving organs.

If a vibrating tuning-fork be placed on the forehead of a deaf person, he will naturally think that he ought to hear better on the least deaf side; and will often assert that the sound is more audible on the side on which he hears you speaking than on the other side.

Luckily for themselves this is not the case with the generality of deaf people, though they think it should be so; after trying two or three times, they are generally obliged to admit that they hear the tuning-fork best with the deaf, or deafer ear. I cannot do better than quote Allen on this subject. He says:—"The common speaking-tube is a familiar example of sounds being strengthened thus, when confined in cavities of any sort. That this is the case with regard to the tympanum and its continuous tube, the osseous meatus, may be proved by closing the external passage with the fingers, when, if a tuning-fork be set vibrating on the head, or a humming sound, or reading be kept up, the sounds, being conveyed through the cranial bones to the cavities of the ear, will become considerably intensified. This fact is made still more evident by placing a vibrating tuning-fork on the forehead, and stopping up one ear with the fingers; the sound will then be more audible on that side. The way, therefore, in which we distinguish affections of the sound-conducting portions of the ear from those of the nervous, or sound-perceiving apparatus, is as follows:—If the patient be deaf to the sounds of a watch, or a tuning-fork, held near (not touching) the external meatus, and yet can hear distinctly their vibrations when conveyed through the solid structures of the head, teeth, and the like, it may be inferred that some obstruction exists to the passage of sound through the meatus, membrana tympani, or tympanic cavity, but that the functions of the acoustic nerve are unimpaired.

"The surgeon may also assume that the conducting apparatus is in fault if the vibrations of the tuning-fork and the patient's own voice are not better heard

when he closes his ears, because it has been shown by the above experiment that the closure of the meatus amplifies all sounds transmitted through the skull or interior of the mouth. It is obvious that catarrhal diseases, whether of the tympanum, its contents, or its external membrane, would hinder the escape of the intensified sounds outwards through the meatus, just as effectually as would be done by a plug of wax or the stopping fingers. Consequently, you may generally and safely conclude that you have to deal with a case of obstruction of the free entrance of sound into the internal ear, and not with a nervous affection, if the patient admits that he decidedly hears the vibrating tuning-fork on the deaf, or deafer side. Lastly, ascertain also whether the patient can hear the vibrations of the tuning-fork on the head for as long a time as you yourself can. The moment he ceases to distinguish the sounds, place the fork on your own head, and you may thus determine the difference. Inversely, of course, if the fork be heard very indistinctly, or not at all, when placed on the vertex, we must infer that the auditory nerve is not so sensitive to the impression of sounds as it ought to be, and that either there exists some abnormal pressure upon the labyrinth fluid, or that the nerve itself is implicated in disease.”*

The reason why the tuning-fork is heard better on the deaf side in cases of diseased condition of the sound-conducting portions of the ear is this, as Hinton says :—
“ When any sound reaches the nerves of hearing through the cranial bones, it is heard more intensely if the

* “Lectures on Aural Catarrh,” by Peter Allen, M.D., p. 52.

† “Supplement to Toynbee’s Diseases of the Ear.” by James Hinton, M.R.C.S., p. 425.

meatus be closed. If, for example, a tuning-fork be placed on the vertex, and one meatus be closed by the finger, the sound will be heard much more distinctly on that side.

“ It appears to be due simply to the prevention of the escape of the sonorous waves, which are thus thrown back in greater intensity upon the internal part of the organ, and it depends upon the fact that the tympanum in the natural state is easily permeable to sound in both directions—in fact, sonorous vibrations from within escape through the ear, just as vibrations from without enter by it.”

By speech we can occasionally determine accurately the degree of deafness from which a patient may be suffering. All vowels can be heard at a much longer distance than consonants.

Dr. Woolf, of Frankfort-on-the-Maine, has published a very able paper respecting the acoustic characters of the elements of speech. He shows that the broad A sound is heard farther than any other vowel ; and that H without a vowel added to it, is the weakest of all the consonants. That if you shout at a deaf person, he will often not hear you so well as when you whisper or speak in low tones.

Burnett* puts this admirably :—“ It has been said a deaf person always hears, when it is especially desired that he should not. This is due to the physiological acoustic fact, that in low spoken tones the vowels are quelled, and the consonants being allowed thereby a better utterance, are relatively strengthened, and the whole word is heard better than if roared out. This damping of vowels has both its good and bad side. Do

* “ A Treatise on the Ear,” by C. H. Burnett, M.D., p. 214.

not elevate the voice too high when you wish to make a deaf person hear, but do not lower it too much, unless to a whisper, if it is not desired that he should hear."

It has been shown by Dr. Blake, that when the membrana tympani is perforated, higher musical tones can be detected than when the membrane is in its normal condition. Hearing these high tones is of great value in diagnosis, and he remarks that the limit of the perceptive power of the cochlea exceeds the limits of the sound-transmitting power of the structures of the middle ear in their normal condition; that therefore the structures of the middle ear in their normal condition present a barrier, as it were, to the passage of sonorous vibrations above a given point; and that the perceptive power of the internal ear remaining the same, morbid changes in the middle ear result in a variation in the limit of their transmission of musical tones."

With these remarks on the ear speculum, the watch, and the tuning-fork, &c., without the use of which we are not in a position to arrive at any diagnosis in affections of hearing,—I proceed to diseases of the external meatus.

CHAPTER IV.

DISEASES OF THE EXTERNAL MEATUS.

IMPACTION OF WAX is a very common cause of deafness. To remove this obstruction nothing more than the syringe and warm water is necessary. No force should be used; but sometimes where the wax is very hard, it may be necessary to pour into the ear a warm solution of bicarbonate of soda (10 grs. to the ʒi) at bedtime, two or three times, before it is possible to remove the whole mass of wax by the syringe. The patient should always stop up his ear with cotton wool after the removal of the wax. The syringe should be used gently and slowly, as the employment of much force will cause giddiness, and may rupture the membrana tympani. We should be careful not to give too favourable a prognosis in such cases, for, as Von Tröltsch observes, masses of wax constantly increasing may lead to perforation of the membrane, to gradual dilatation of the osseous meatus, or to the formation of ulcers, and even worse evils. Moreover, impacted wax may cause thickening of the surface of the membrane, or even an abnormally deep position of it with narrowing of the tympanum and over pressure upon the contents of the labyrinth by the stapes. Ear-picks should be especially avoided, for severe injuries are often caused by these instruments, in the form of sharp metal probes, hair-pins, bodkins, knitting-needles, &c., used for the relief of itching in the ears, or for the removal of foreign bodies.

"The secretion of the meatus, known as cerumen, or ear-wax, is, according to Petrequin and Kessel, of a smeary consistency, on account of the soapy material made by the potash which it contains. A part of it is soluble in water; another in water and alcohol. It also contains about 10 per cent. of water, a mixture of oil and stearine, and a dry material, not soluble in water, alcohol, or ether, in which traces of chalk and soda are found. As age advances, the parts of the cerumen which are soluble in water increase, but those soluble in alcohol diminish, so that in old persons the cerumen becomes dry and brittle. The contents of the ceruminous and sebaceous glands together is a yellowish-white, rather fluid material, which consists essentially of small and large fat globules, corpuscles of colouring matter in masses, and cells in which single globules of fat and colouring matter are embedded; hairs and scales of epidermis are also found in the canal."*

CASES.—1. Mrs. C., who consulted me in October, 1874, informed me that she had been deaf for fifteen years, but that lately the malady had been increasing. She complained of great noise in both ears, and was unable to hear a watch in contact. The cause of her deafness was very evident, for both ears were completely obstructed with hardened cerumen.

I immediately removed a very large piece of wax from each ear. Her hearing, of course, instantly improved. Her satisfaction was great at hearing the rustle of the "Times," as she took it up to read, for, "she had not heard that sound previously for fifteen years." Both tympanic membranes, although rather opaque, looked remarkably healthy, considering how long the obstruction had existed.

2. Mr. R., a surgeon, consulted me for the same cause. He

* "Diseases of the Ear," by Dr. St. John Roosa, p. 160.

could not hear the watch in contact with either ear, and he was suffering a good deal of pain. His deafness was increased by hunting in the country in a cold wind. Both ear passages were unusually small, so that I had some little difficulty in getting away the obstruction. After using the syringe gently for some considerable time, large pieces of wax came away, and his hearing returned. He had suffered in this way for some years; the tinnitus aurium had become unbearable, but ceased when the cerumen was removed from contact with the membrana tympani. The latter structure was dark in colour, and somewhat thickened in each ear.

3. The Rev. A. W. came to me August 28th. He had previously consulted a well-known surgeon, who had diagnosed cerumen, and used the syringe, but had only succeeded in removing a portion of the wax. The surface of that which remained assumed a peculiar honeycomb appearance, which had led the surgeon to consider that the patient had entirely lost the whole tympanic membrane of the right ear, and nearly all that of the left. By carefully syringing (in the manner I have elsewhere described), I soon removed the accumulation from both ears. I found the tympanic membranes quite healthy, and his hearing was completely restored. I have seen many other cases of impacted wax, and also cotton-wool, assuming a great variety of appearances, calculated more or less to mislead the surgeon; so that I am not surprised at the mistake that was made in this case.*

4. Miss Q., æt. 22, of Bury St. Edmunds, came to consult me, October, 1877, for deafness in her left ear. She said that she had been slightly deaf for several years, but for the last two months she had almost entirely lost her hearing. She stated that her mother and sister were both deaf in the left ear. I removed a large plug of cerumen, and she heard perfectly well. Her sister, aged 18, afterwards came to see me. She could not hear the watch in contact with her left ear, and she remarked that she never remembered having heard a sound of any kind on that side. After some little difficulty I removed an immense lump of black-looking wax, and her hearing was likewise restored.

Were it not for the apparent ignorance of the bulk of the profession of the rudiments of aural surgery, I

* "British Medical Journal," Oct. 6th, 1877.

should not think of publishing such cases ; but while so much and yet so easily remediable suffering exists, surely it becomes a duty to try and disseminate the simple truths necessary to relieve it.

My note book contains many similar cases, but the four I have given are sufficient to illustrate the subject. The first is somewhat remarkable for, usually, if wax is allowed to remain for so long a period in the external auditory meatus, the hearing is a great deal more affected than in this instance. The cases are very numerous in which patients neglect slight deafness from an accumulation of wax, until permanent mischief is induced.

It is not uncommon to meet with patients who suffer from deafness, from a collection of epithelial laminae,* which condition has been called "keratosis obturans, in contradistinction to ceruminosis obturans, the impacted plug of ear-wax ; the laminae are derived from the horny elements of the external auditory canal, by gradual accretion, causing great deafness and offering great resistance to removal."† I have always found the use of warm solutions of bicarbonate of soda, as I have before recommended for obstinate cases of hardened cerumen, the best treatment.

Toynbee‡ gives an analysis of such cases. He says :—"Of 165 ears from which cerumen was removed, only 60 were cured, besides 43 cases that were much improved. Thus there were 103 cases of great ameliora-

* First described by Wrenden of St. Petersburg in the "Archiv. of Ophthalmology and Otology," 1874.

† See "A Treatise on the Ear," by C. Burnett, M.D., pp. 293, 294 ; also Dr. Duncanson, "Edinburgh Medical Journal," Nov., 1878, p. 477.

‡ "Diseases of the Ear," p. 48.

tion, while there were 62 ears that were either but slightly or not at all improved. It is therefore important that every case should be carefully examined after a collection of this kind has been removed; because if the hearing power is not wholly restored, some other disease must be present which requires attention."

The secretion of wax in children is sometimes in a fluid state and highly offensive, and, if not speedily treated is likely to lead to catarrhal inflammation or more serious mischief.

In adults it is sometimes entirely absent, but the deficiency does not seem in any way to affect the hearing power.*

And now a few words as to the best mode of removing foreign substances introduced into the meatus. Generally speaking, the instruments introduced for their removal do great mischief. Instrumental interference is hardly ever necessary, and it is often a dangerous practice. Careful use of the syringe and warm water will almost always be successful if perseveringly applied, especially if the auricle is pulled upwards and backwards. If much swelling and inflammation of the soft parts should be present (and this is often very severe from irritation and pressure of the foreign body), to relieve these, together with the acute pain, leeches should be freely applied in front of the tragus; for the meatus and membrana tympani are extremely sensitive when pressed upon by hard substances. After the in-

* The absence of wax does not in itself seem to have any ill effect on the power of hearing; but a condition of unusual dryness in the external meatus is often associated with diseases of the internal ear.

flammation has subsided by this means, and also by the use of fomentations, the syringe will easily remove the foreign body; but we should by no means attempt the removal as long as the slightest tumefaction is present. Above all, it is necessary always to make a careful inspection of the meatus with the speculum to see whether there is something to remove. Often and often have most lamentable results followed attempts to remove with instruments substances which have either never been in the ear at all, or have fallen out of it unnoticed. Inflammation of the brain, and death, have not unfrequently been caused in this way; or, if life has been saved, total deafness has followed. Vomiting and coughing are sometimes met with from irritation of the auricular branch of the pneumogastric (Toynbee). These symptoms of course instantly vanish when the pressure is removed. It is often advisable to turn the patient on his side and syringe from below, or, as Hinton first pointed out, "to place him on his back, if the foreign body, as frequently happens, is jammed into the angle formed by the anterior wall of the meatus and the membrana tympani." The agglutinative method of removal is strongly recommended by some authors; it consists in fixing the impacted body by means of glue or coaguline to a piece of linen attached to a holder, and to withdraw the same when the glue has firmly set on the foreign body. Adhesive plaster may be used in the same way, attached to a piece of string.

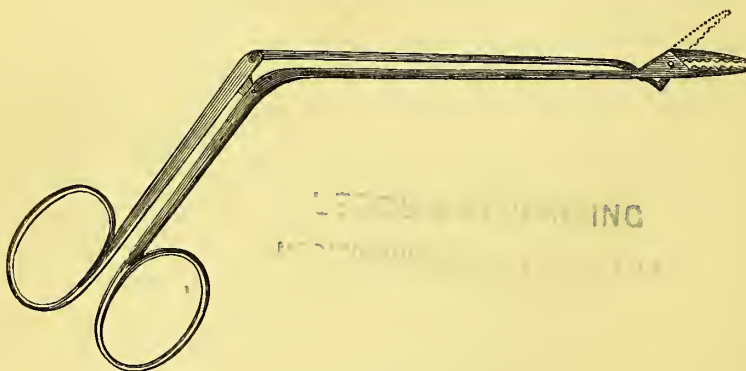
The substances I have most frequently met with are beads, small stones, peas, cherry-stones, slate pencil, pieces of tobacco-pipe, shells, paper, cotton-wool, sealing-wax, and grass.

Beans, peas, and the like, are very troublesome to

remove, as they often swell from moisture and cause intense pain. The other day, at the hospital, I removed an immense lump of tobacco from a labourer's ear, which caused him, as may well be imagined, great pain. The lower orders seem to think this an infallible remedy for every ailment connected with the ear.

But, with most substances, rather than use any force in attempting to remove them, it is far better to let them remain in the ear.

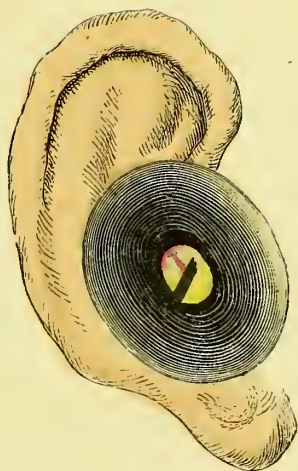
The foregoing remarks may appear unnecessary, but I can affirm that in nearly every case in which a patient has been brought to me with a foreign body in the ear, mischief has been caused by some anxious friend using a hair-pin, or from constant endeavours having been made to get rid of the enemy by the use of a probe or other instrument.



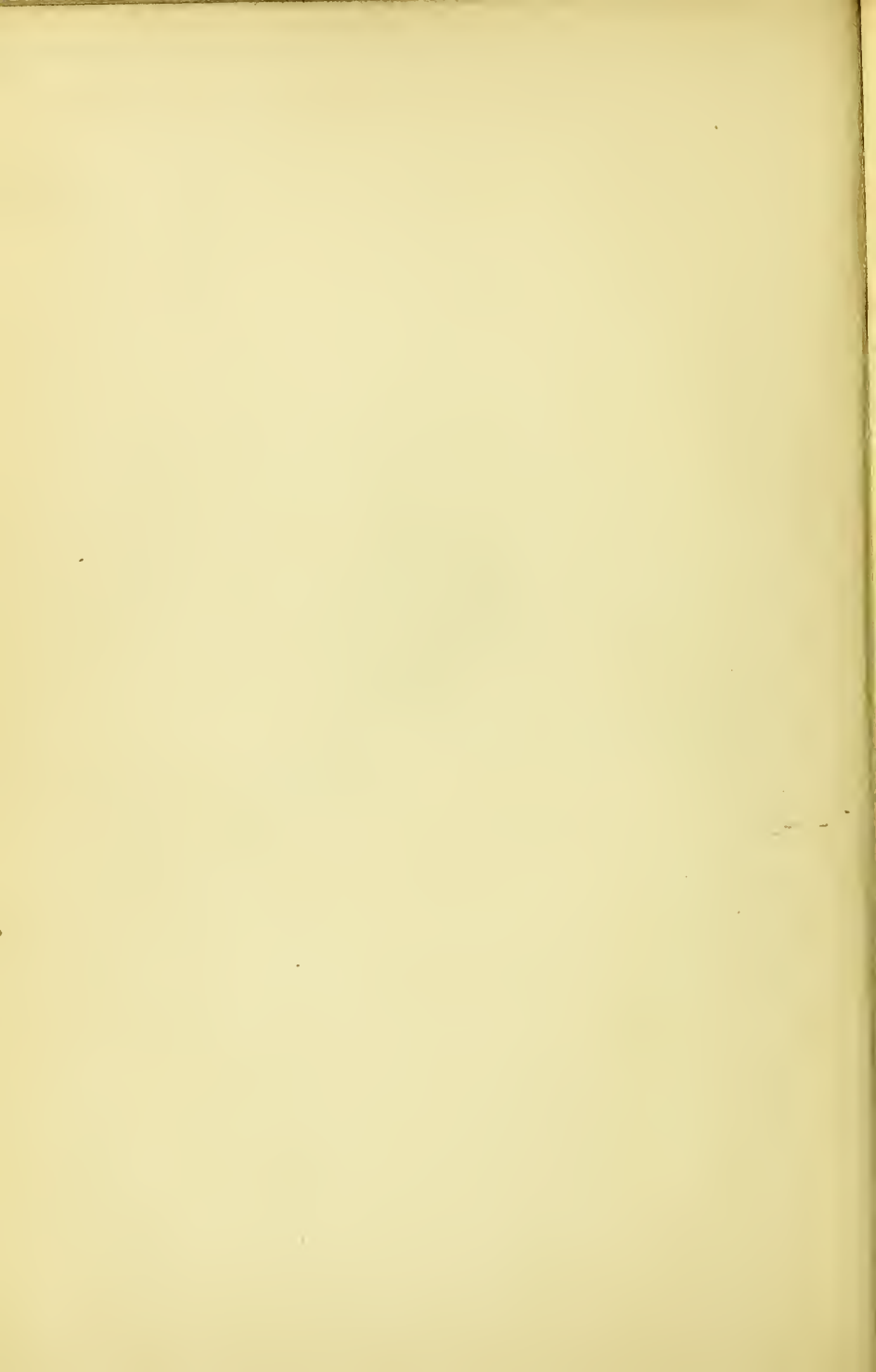
FORCEPS FOR REMOVAL OF FOREIGN BODIES FROM THE EAR.*

The following are two examples of intense suffering caused by endeavouring to remove foreign bodies by

* Made by Weiss and Son, 62, Strand.



IMPACTED GLASSBEAD WITH ACCOMPANYING CONGESTION AND DISCHARGE.



instrumental means. Both came under my observation in one week.

5. A. E., a little girl, æt. 10, was brought to St. Mary's with a large glass bead in her right ear. She was in very great pain. The walls of the meatus were lacerated and swollen, and the ear was filled with coagulated blood. The mother informed me that she herself had first tried to get out the bead with a hair-pin, and afterwards she had taken her to three doctors, who, as she expressed it, "had all had a try." These repeated efforts had not improved matters. The glass bead could just be seen glistening, deeply seated in the meatus. I at once used a syringe: the mother said that this had been done very frequently already. The bead, however, came away very easily, and I have no doubt that if the nozzle of the instrument had been applied to the roof of the external meatus instead of to the floor (which is the common way of using a syringe) the bead would have come away at the first attempt.

6. The other case was that of a boy, æt. 8, who was brought to the hospital with a large white pebble in his left ear, and which completely filled up the meatus. The ear was intensely painful and swollen, from efforts that had been made to pull out the pebble. I ordered six leeches in front of the tragus, and the next morning I syringed away the stone without difficulty.

Instruments are seldom necessary, but, as in the following case, the foreign body may be so firmly impacted that it is impossible to extract it unless dislodged by instrumental means. In the majority of instances the foreign body has become thus fixed, from unsuccessful attempts at removal, the patient being unable to keep quiet in consequence of the great pain thus caused. An anæsthetic should in such a case invariably be administered.

7. In December, 1878, a gentleman brought his son, æt. 12, to see me. Six weeks previously the boy pulled out the upper half of a bicuspid tooth, and put it into his left ear. He was at once taken to see a surgeon, who readily seized the tooth with a pair of forceps, but just as it was on the point of being extracted, the lad forcibly threw up his arm against the hand of the operator, so

that the tooth was suddenly driven inwards and so impacted that it was found impossible to remove it. Several attempts were made subsequently to dislodge it, without avail. He was then sent up to London to consult me.

The tooth was firmly wedged and deeply seated in the external meatus, so that I found it impossible to remove it by syringing.

Having placed the boy under chloroform I passed a very fine bent probe along the upper portion of the meatus, and so behind the foreign body, and drawing it slightly forwards it was easily removed, although it was very firmly impacted. The tooth had cut its way through the lower portion of the membrana tympani; the patient, however, made an excellent recovery.

Similar cases are very frequently met with in practice, and I am certain that, if the means I have suggested were more frequently adopted, we should very rarely have to deal with those less fortunate patients who occasionally present themselves at the hospital, with foreign bodies lodged in the tympanum, often-times resulting in total deafness, or even in a worse fate. Voltolini says truly, "even the point of a dagger, if allowed to remain quietly in the ear, will not do as much harm as forcible attempts to remove it. He recommends the use of the galvano-cautery in some cases, employing the finest points, he gradually burns a hole in the foreign body, which breaks up and is then easily removed.* But at the same time, foreign bodies should not be allowed to remain in the ear too long. The following case is remarkable:—

8. T. B., æt. 6, was brought to me in March, 1874, having suffered for nine months from deafness and from great pain (especially at night) in the right ear. His mother said that he had "suffered agony," and every now and then he put his hands to his head and cried out from the severity of the pain. He had been

* "Medical Times and Gazette," August 24th, 1878.

taken to several medical men without any benefit, and was told by some that he had a gathering, and must poultice the ear; whilst others said that he had a polypus; but the last gentleman she took him to discovered a hard substance, and recommended him to be brought to me at St. Mary's. She said that he had been blistered and poulticed regularly for nine months without any benefit. He was unable to hear the watch in contact, and on examination I found a hard substance covered with thick yellow matter. Having carefully syringed, after a little trouble I removed a large smooth oval stone, which had remained in his ear for nine months, had given rise to dangerous symptoms, and permanently affected his hearing.

9. M. P., a little girl *æt.* 6, came to the hospital with a black glass bead of the size of a large pea in her left ear. She was sent to see me by Mr. Lane. Previously, however, to her coming to the hospital, several attempts were made to extract the bead; but, unfortunately, the mischief was only increased thereby, the bead having been pushed in still deeper, and firmly imbedded, the result of subsequent inflammation. I syringed gently, and postponed any further attempt at removal (as there was a good deal of inflammation) until my next hospital-day. She was, however, laid up with chicken-pox for two months, and when she came to the hospital (February 16th) all inflammatory signs had disappeared; but the bead could easily be distinguished with the speculum, deeply seated and firmly fixed. She was put under chloroform, and an attempt was made to remove it by means of glue attached to the end of a piece of stick. This failed altogether. She was, therefore, placed on her side, with the affected ear downwards, and the syringe used from below; and, after a little trouble, the bead dropped out.

This is a case which one is likely to meet with almost every day. A great deal more harm than good is often done by the use of instruments; but by the following method no injury can be caused.

How to Syringe the Ear.—Place the patient under chloroform, with the ear affected downwards, and syringe from below. Pull the auricle backwards and upwards (by this means the external auditory meatus

is made into a straight tube), and apply the nozzle of the syringe to the upper wall of the passage. The water is then gently forced behind the obstruction; the foreign body is loosened, and its own weight will cause it to fall out of the ear. I have removed all kinds of substances in this way.*

Foreign bodies in the external auditory meatus occasionally give rise to epileptiform symptoms; such instances have been recorded by Handfield Jones and others. These cases somewhat resemble Ménière's disease.

* "British Medical Journal," March 4th, 1876.

In the "British Medical Journal" of the following week, in confirmation of what I have just said, Mr. Rivington, of the London Hospital, made the following remarks:—

"Having had considerable experience in the removal of foreign bodies from the ear, I can strongly support the recommendations of Mr. Field of St. Mary's Hospital, contained in the Journal of March 4th. From the time of my first connection with the Aural Department at the London Hospital I have used no other means of extraction of foreign bodies than the syringe, aided occasionally by chloroform, the dependent position of the organ, and the use of a small pair of curved forceps as soon as the substances appeared near the external end of the meatus; and I have never failed in procuring their ejection.

"I must not conclude these few remarks without expressing my obligation to the late lamented Mr. Hinton for the kind assistance which he rendered to me some years ago, when desirous of acquiring some little knowledge of the method of examining aural patients. I remember speaking to him about the extraction of foreign bodies, and asking him what method he recommended for their removal. He replied that "You will not use any other method than the syringe if you are wise." With the slight exception specified above, I have never done so; and I feel sure that those who adopt the sound advice tendered by Mr. Hinton and Mr. Field will never have occasion for disappointment or regret."

Instances are recorded of needles, the points of glass syringes passing through a perforation in the membrana tympani, into the tympanum and Eustachian tube. It is important to remember in all cases of this description that more harm than good is generally done by probing and other violent attempts at extraction. The following is the case of a pin in the Eustachian tube:—

10. H. W. S., a clerk, æt. 21, came to consult me at the hospital on November 7. He stated that several years ago he injured the drum of his right ear with a piece of slate pencil. A few days ago he was picking the same ear with a small pin, when it slipped in, and he could not get it out again. The pin was seen distinctly by three medical men, who in endeavouring to remove it pushed it completely through the perforation in the tympanic membrane. It was then that he came under my notice. He complained of great pain in his throat at the lower end of the Eustachian tube, and occasionally, when his neck was touched, the pain became suddenly acute. As it seemed to be impossible to remove it, I suggested that he should eat a quantity of bread and swallow it in large pieces, with the hope that as the act of swallowing causes opening of the Eustachian tube (by contraction of the tensor and levator palati muscles), the pin might be released, and the bolus of bread assist to carry it onwards with comparative safety, at any rate, through the œsophagus. This treatment had the desired effect, for after a time he felt the pain move down his throat. He has never since suffered any inconvenience. The termination is not altogether satisfactory, for although the acute pain, made more intense by the slightest pressure, was altogether checked by the onward passage of the pin, nevertheless, as the patient has not wittingly passed it, its whereabouts is still a subject of speculation. This case shows how foreign bodies may pass through the tympanum, down the Eustachian tube, without giving rise to such severe symptoms as one would be led to expect.

CIRCUMSCRIBED INFLAMMATION OF THE EXTERNAL AUDITORY CANAL, or boils, are frequently found in the

meatus. They generally occur in people of middle age. They are, as a rule, extremely painful. The following is a case in point:—

11. A lady, æt. 56, came to me for relief from intense pain in the right ear; she could not bear it touched. I ordered linseed poultices, which considerably relieved her, also a quinine and iron tonic. In two days' time I opened the abscess freely; in a week she was quite well.

Some authors recommend pouring into the ear a strong solution of sulphate of zinc to induce resolution, or the application of nitrate of silver. I prefer the treatment just described. The only kind of aural disease in which poultices ought to be used is, in my opinion, when the surgeon finds such intense suffering as arises from a boil in the external meatus. Here they are of great service: in all other varieties of inflammation they only lead to increased suppuration and probably perforation of the membrana tympani. I have seen blisters occasionally ordered behind the ear: these merely increase the irritation and are only of service in certain cases of chronic discharge. In all acute forms of aural disease they should be avoided. Glycerine poured into the ear will often be found useful for relieving pain in these cases. Abscesses in the meatus occasionally form a fistulous opening in front of the tragus, or tend to* “an evacuation of their contents through the duct of Steno, or through the cleft found in the posterior superior part of the cartilage of the auditory canal, as described by Poorten after the occurrence of otitis externa circumscripta.”

* “Diseases of the Ear,” Burnet, p. 315. See also paper by Sir James Paget, Clinical Society Reports, 1878.

INSECTS often enter the meatus. Syringing with warm water is all that is necessary to stop the irritation which they produce, and effect their removal. It is very common to meet with patients who imagine they have insects in their ears. A woman attended at the hospital who insisted that she had a black beetle in her ear, and was deeply offended with me when she was told that nothing of the kind was visible. Simple folk from the country I have found have a predisposition to recognise the presence of earwigs.

A vegetable FUNGUS is sometimes met with in the auditory passage.

"The *aspergillus*," according to Roosa, "is the one most commonly found. The symptoms are similar to those from inspissated cerumen. There is a sensation of fulness in the ear, with tinnitus, impairment of hearing, and pain. Pain, however, is not a common evidence of inspissated cerumen, but it is, on the contrary, one of the symptoms of otitis parasitica. It is a dull, heavy sensation in the ear; it is not a primary disease, but a consequence of diffuse otitis, which may have been of very mild form. It is very often found after eczema. Some kind of inflammation, which loosens the epidermis, has first occurred. The fungus is actually such a 'mould,'—as clings to damp walls and adheres to bread not kept thoroughly dry. As we might expect, the habit of the Russians to live—as they are almost compelled to do—in badly ventilated rooms during their long winter, is very favourable to the production of *aspergillus*."

The best treatment is to syringe the meatus frequently with warm water and alcohol. The most common appearance of the fungus is exactly like fine coal dust blown into the ear.

“ These vegetable fungoid growths in the ear were formerly mistaken for impacted cerumen and otitis externa. Their whitish or blackish flakes, adhering to the walls of the canal or to the membrana tympani, may easily be mistaken for epidermis or hard wax. When the casts are removed the tissue beneath is found to be reddened and tender, and in a few hours the growth will be found to be reproduced. The microscope must be called in to make the diagnosis certain.”*

* “ Diseases of the Ear,” Roosa, p. 135.

CHAPTER V.

DISEASES OF THE EXTERNAL MEATUS

(continued).

CHRONIC INFLAMMATION OF THE EXTERNAL AUDITORY MEATUS often leads to narrowing of the passage until the latter is often so small that a probe cannot be passed through the opening. Small indolent ulcers form which keep up a constant irritation, and give rise to a discharge sometimes thick and offensive, but more frequently watery and without smell. Mild astringent lotions may be used, and tonics should be given to keep up the general health of the patient. A strong solution of nitrate of silver should be applied by means of a very small probe and cotton-wool, to the ulcerated surface, at least twice a week.

In a favourable case the discharge gradually ceases, the ulceration heals and the passage will be widened to such an extent that the hearing is restored.

12. A patient, Mr. G. S., consulted me in October, 1878, who had been suffering in this way for eight years. He had become so deaf from the contraction of the external meatus in both ears, that he was obliged to give up his occupation. The passages were so small, that there was scarcely room enough to pass a small probe through the narrowed openings. When he consulted me, October 1st, 1878, he could hear the watch one inch right ear, and three inches in the left. This he described as being one of his "good days," for often if he took the least cold, a slight discharge would come on, completely blocking up his ears, and rendering him almost totally deaf.

Regularly twice a week I passed a fine probe covered with

cotton-wool, and by this means applied a solution of nitrate of silver 30 grs. to ʒj to the ulcerated surfaces.

He also used an ointment daily, composed of 1 part of the ung. hydrarg. nitratis to 8 of ung. zinci.

Small doses of arsenic and iodide of potassium were prescribed. Under this treatment his hearing was rapidly restored. On October 4th he could hear two inches right and six left ear; in six weeks' time he could hear my watch three or four yards away in both ears.

This narrowing of the canal, however, may arise from a variety of causes, such as erysipelatous inflammation.* For it has been noticed† that erysipelas frequently begins when the skin loses its dryness, and other characteristics of ordinary skin, that is at the entrance of the external auditory meatus, just as happens at the entrance of the nose or at the edges of the eyelids, &c.

The treatment to be recommended for narrowing of the ear passages depends upon, and must be adapted to, each individual case that is brought before us, for the cause of the narrowing is generally evident.

13. In January, 1879, I admitted a patient into the hospital with complete closure of the right external auditory meatus.

He stated that some years ago he pricked his ear with a pin; violent inflammation ensued, and eventually the passage closed up. I removed the band of hardened skin, and keeping the meatus plugged with cotton-wool soaked in a solution of carbolic acid, a permanent opening was made, and he heard well again.

MALFORMATIONS of the auricle will likewise sometimes cause a covering over of the auditory canal, but in such cases there is often an entire absence of the external auditory meatus.

The canal may be closed by a cutaneous band in the

* Itard, "Maladies de l'Oreille," p. 168.

† Reynolds' "System of Medicine," vol. 1, p. 542. (3rd Edition.)

cartilaginous portion of the meatus. Dr. Ray lately brought me a little boy who was suffering from a congenital malformation of this kind, the passage was very narrow and imperforate, for a band of skin completely covered in the opening.

14. I lately saw a girl, *æt.* 6, in consultation with Dr. Milson, whose ear appeared to be folded forwards.

The helix was doubled over and firmly attached to the tragus, the anterior and posterior edges of the lobule were also joined together; in fact the ear was completely doubled forwards, leaving a small opening leading down to the fossa of the antihelix. The child could plainly hear a watch when placed in contact with the ear.

ENLARGEMENT OF THE OSSEOUS WALLS is not unfrequently met with, especially in women, causing a narrowing of the ear passage and consequent difficulty of hearing. Small ivory bougies, three-quarters of an inch long, are often very useful in these cases.

EXOSTOSES often form and in the same way impair the hearing. Tincture of iodine freely applied used to be considered the best treatment. Wilde recommends "counter-irritation, depletion, and mercurials to arrest its progress in the early stage when there probably exists a chronic state of periostitis."*

15. M. W., a little girl *æt.* 3, was brought to the hospital on July 25th. Her mother stated that she had suffered from a severe attack of measles twelve months previously, and that she had since had an offensive discharge from the left ear. I had a few months since removed a polypus. About a fortnight ago, she noticed a hard substance in the ear, causing the child much uneasiness. When she came to the hospital, a small pedunculated osseous tumour about the size of a pea was discovered, almost filling up the meatus.

This case well illustrates the etiology of aural exos-

* Holmes' "System of Surgery," vol. 3, p. 150.

tosés, as seen by the light which modern pathology has thrown upon inflammation of bone and resultant new growths of this tissue, and which Dr. Cassells has recently very correctly described.* This, however, is only one form of the disease. Such tumours are frequently pedunculated, and might, indeed, be removed by the wire, as he has suggested. On the other hand, there is another and far more serious form of exostosis of ivory consistency (still less frequently met with), partaking of the nature of a new growth, and quite independent of inflammatory changes. Such growths of bone in other parts of the body would be called hyperostosis. Their development is insidious, and they occur in apparently healthy organs. Their very existence is not suspected until the patient discovers that his hearing is rapidly failing him; while the absence of pain might lead him to regard it at first as a trivial matter. The following is a good example of ivory exostosis in both ears:—

16. G. M., a medical man, æt. 32, strong and healthy, consulted me on October 4th, 1877. He stated that when a lad at school he had suffered from pains in the right ear, followed by slight deafness. He consulted the late Sir William Wilde, of Dublin, and in a short time he recovered perfectly. In September, 1877, he again became deaf, after bathing in the sea, and as there was some swelling visible in the meatus he took iodide of potassium, while leeches were applied, together with counter-irritation, behind the ear. On September 25th leeches were again applied. On October 1st a somewhat similar condition was discovered in the left ear.

On October 4th he came to London and placed himself under my care. The swelling in both ears looked exactly like a deep-seated boil, and the hearing remained remarkably good, consider-

* "The British Medical Journal" for December 15th, 1877.

ing that only a very narrow passage was left for the conduction of sound. After some days an incision was made into the swelling, the knife coming in contact with a bony growth of a very hard nature. There was no pain, and very little redness until the growth pressed against the opposite wall of the meatus, and then slight inflammatory action took place, and the patient became very deaf. He complained of a most distressing fulness in the ears, with severe tinnitus aurium. He suffered from great depression of spirits, and this was augmented in small degree by the knowledge of the density which characterises an aural exostosis. He knew that his deafness was due to a complete closure of bone, and as he could only hear the watch in contact, he felt that he was thus, from inability to join in conversation, shut out from all society.

On October 11th my colleague, Mr. A. T. Norton, saw the case with me, and it was arranged that an operation would be necessary for the removal of both exostoses.

October 13th.—The patient having been placed under chloroform, I proceeded to drill through the growth in the right ear with the American dental engine, kindly lent me by Mr. Sewill. The exostosis almost filled up the external meatus, and took its origin from the posterior wall, extending from a quarter of an inch from the orifice to within a very short distance of the membrana tympani. I thought it necessary to protect the membrane and its adjacent important structures, as far as possible, by having an instrument made to shield them from injury. Messrs. Weiss and Son therefore made me a soft metal guard, which was passed with slight difficulty along the anterior portion of the meatus, and was then bent to the angle required to pass behind the exostosis. Having obtained the exact shape necessary, another similar instrument was made of steel, which was found to answer the purpose admirably, for it made an accident almost impossible. After working steadily for an hour and three-quarters, I succeeded in drilling through a greater part of the growth. The operation was rendered difficult, not only from the extreme density of the tumour, but also from the fact that the growth was deeply seated, and was repeatedly hidden by the blood persistently filling up the meatus. The patient suffered terribly from sickness for two days after the chloroform, but otherwise went on well.

On the 28th I enlarged the opening in the exostosis of the

right ear, under chloroform, drilling completely through the growth. On the 29th he suffered much from sickness.

On November 11th I operated on the left ear. This exostosis was found to be worse than the other for removal, being of larger size. The patient was, as on the former occasion, very sick for two days after the chloroform.

On December 2nd I repeated the operation in the left ear with a larger drill. During this and the subsequent operations the patient took ether, and he did not suffer in the slightest degree from sickness, although he was over an hour under its influence. A large opening was made, and he was able to hear perfectly well for ten minutes or so after the operation. Two or three days afterwards violent inflammation, unfortunately, was set up in the *membrana tympani*, which became perforated. Six leeches were ordered in front of the tragus, followed the day after by four more. The ear was constantly washed out with a weak carbolio acid lotion, and the perforation after two or three days completely closed.

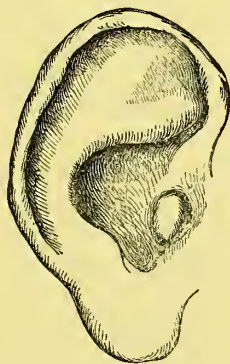
January 13th.—The passages of both ears were blocked up again by red granulations; these were removed, and afterwards red oxide of mercury was applied, and also nitrate of silver, in strong solution. These applications gave such intense pain that they had to be discontinued. Tannic acid was then substituted for some considerable time. There was a profuse discharge of thick pus, which completely prevented hearing. This gradually subsided, and now he is able to hear perfectly well all day long, but at night he is again deaf from collection of discharge in the passage; but when this has ceased, his hearing will no doubt be perfect, at any rate in his left ear.* The passage in the right ear is very much smaller, and on some further occasion I propose to enlarge the opening.

The American dental engine, first suggested for these cases by Dr. Mathewson, of New York, is, I think, perhaps the only instrument likely to succeed in penetrating such tremendously hard growths of the petrous bone.† The patient was seen with me at different times

* Since this was written he has quite regained his hearing in both ears.

† In a paper by Arthur Mathewson, M.D., Brooklyn, N.Y.,

by Sir James Paget, Mr. Dalby, and Mr. Thomas Smith, who kindly gave me their valuable advice. I am indebted to my colleagues, Mr. Norton and Mr. Edmund Owen, and also to Dr. W. Mackesy, of Waterford, for valuable assistance during the operations. For the successful termination of the case I have to thank the patient himself most of all, for the pluck with which, time after time, he submitted to be operated upon (seven hours in all under chloroform and ether) is beyond all praise.



EXOSTOSIS PROJECTING FROM THE POSTERIOR WALL OF THE EXTERNAL MEATUS.

This ivory exostosis has been observed to be much more common in men than in women. It arises almost invariably from a broad base on the posterior wall of the external meatus, either as a long bony ridge or as a round tumour or tumours. This form is acquired, and not congenital. Its growth is not rapid, nor have we often any signs of inflammation until the patient becomes suddenly deaf from the complete occlusion of the

in the "Transactions of the International Otological Congress," 1876.

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CHIRURGICAL SOCIETY

meatus, and consequent irritation set up thereby. The other form of exostosis is generally pedunculated in shape, arising, for the most part, from the middle ear, the result of inflammatory process. Its growth is rapid, and the suppuration is plentiful and very offensive, and a polypus, arising from the exostosis, sometimes precedes its appearance into the external meatus as in case 15. This form may be removed by wire, which means of operation cannot be employed in the other variety, as exemplified in the case I have described.*

CHALK STONES are found in the upper portion of the helix of the ear in people who suffer from gout. They produce no inconvenience, and Professor Garrod, out of 37 cases of gouty diathesis examined, found them to be present in 16.

According to the same authority† the earliest appearance presented is "that of a small vesicle under the skin of the helix, as if situated between it and the fibro-cartilage; the contents of the vesicle are at first opalescent, or milky, but afterwards become white and opaque, and acquire the consistence of cream. After some months the vesicle assumes the appearance of a hard white bead closely resembling a pearl."

Kramer asserts‡ that gout has no tendency to produce aural disease, but Sir William Wilde has described a form of congestion and redness of the auricle, which he attributes to the gouty diathesis.

MOLLUSCOUS OR SEBACEOUS TUMOURS sometimes block up the passage. It is necessary to remove the capsule of the tumour as well as its contents.

* "Lancet," July 20th, 1878.

† Reynolds' "System of Medicine," vol. 1, p. 854.

‡ "The Aural Surgery of the Present Day," by Dr. W. Kramer, p. 20.

These tumours produce absorption of bone, without occurrence of pain, and often cause an enormous dilatation of the meatus.* They sometimes pass right through a portion of the petrous bone, making a clean cut hole; and they moreover not unfrequently set up brain mischief, sometimes with a fatal termination.

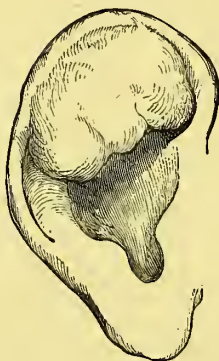
OTHÆMATOMA, or blood tumours of the auricle, may be divided into two classes.

1. Traumatic, the result of violence, as from a severe blow on the ear.

2. Idiopathic, found mostly in the insane, and arising from a diseased condition of the brain. These tumours often attain a large size, and are caused by effusion of blood between the cartilage of the ear and the perichondrium, and are situated on the anterior or concave portion of the auricle. Most writers deny the possibility of the existence of the idiopathic form in the sane. I saw an instance at St. Mary's Hospital a short time ago of a large tumour in the left ear of a Forester, who most emphatically denied ever having met with an injury to his ear, and who was certainly not insane. Similar instances have been described by Gruber and Roosa. Dr. Savage, of Bethlem Hospital, states that he has never seen an insane person recover who has had this hæmatoma. That the mischief in these cases is the result of disease of the base of the brain is proved by the experiments of Brown-Séquard, who produced a tumour artificially in a guinea-pig, by irritation applied to the restiform body on the side corresponding to that of the tumour.†

* Dr. Kirk Duncanson published an interesting case of molluscous tumour, in the "Edinburgh Medical Journal," November, 1877.

† "Burnett on the Ear," p. 251.



OTHEMATOMA.

According to Macnaughton Jones,* "othæmatoma is not confined to any one form of insanity, it is found in mania, melancholia, and dementia, but it occurs most frequently in general paresis and insanity associated with epilepsy."

Treatment.—Evapouring lotions and puncture of the tumour and all kinds of treatment have been suggested, but I have never seen any good results.

MALIGNANT DISEASE.—Epithelioma occasionally attacks the auricle. Amputation of the part is the only treatment to be recommended.

In a case related by Mr. Dalby at the Royal Medical and Chirurgical Society, January 14th, 1879, "a purely local irritation, without any predisposition in the patient towards cancer, had been productive of epithelioma; which, starting from the tympanic cavity, eroded and destroyed in its progress that portion of the temporal bone which included the mastoid process, the external auditory canal, the tympanum, and a large part of the

* "Aural Surgery," p. 152.

petrous portion. In this, as in all other recorded cases of malignant disease of the mastoid bone, the lining membrane of the tympanic cavity had been a discharging surface for a considerable period. In the existence of this discharging surface might be found (according to the writer) the irritation which preceded the new growth.”*

Sir James Paget and others have described a fibrous tumour that occasionally forms in the lobule of the ear from the irritation produced by piercing it for ear-rings. According to Erichsen “they are semi-malignant, like the warty growths of cicatrices, and after excision, their only treatment, are somewhat apt to return.”†

OTORRHAGIA OR HÆMORRHAGE FROM THE EXTERNAL MEATUS is a common symptom of a result of various diseases or injuries. Thus it is sometimes a symptom of purpura;‡ in malignant small-pox blood has been seen to ooze from the ears; it occurs also in yellow fever. Hinton§ mentions it as a symptom of suppressed menstruation. It is most commonly due to injuries to the head, such as fracture of the base of the skull, and if both petrous bones are injured hæmorrhage occurs from both ears. Rupture of the membrana tympani is a very common cause, either from direct injury, or from air being forced with great and sudden violence through the Eustachian tube into the tympanum, causing bursting of the membrane, as in whooping cough, asthma, violent sneezing, and the ascent of high mountains or a sudden descent in a diving-bell, will also produce it.

* See “British Medical Journal,” January 18th, 1879.

† “The Science and Art of Surgery,” vol. 2, p. 314.

‡ Reynolds’ “System of Medicine,” vol. 1, p. 230.

§ “Questions in Aural Surgery,” p. 97.

Wounds of the internal carotid artery have been known to give rise to it, and it may be caused from injuries to the external meatus from polypi, abscesses, &c., &c.

INJURIES to the AURICLE are, as a rule, easily treated, and generally, as in the following case, do well.

17. J. G., a little boy aged 8 years, was brought to the hospital in the Manvers Ward, with the right ear almost torn off, from a fall on some gravel. I carefully sewed it up with 16 sutures, and in a month's time he left the hospital with hardly any trace of the injury.

SKIN DISEASES very often attack the ear, and more than general knowledge of their treatment is necessary to the aurist on account of the deafness they frequently produce. Of these eczema is certainly the most common.

Eczema may be acute or chronic, arising either from constitutional or local causes. In an acute attack, the ear is at times implicated in the general disorder. The eruption may show itself between the ear and head, or it may affect the ear itself. The former is called eczema intertrigo, and is aggravated by the opposition of the parts. This form is common in children, especially infants prone to obesity. The disease affecting the ear itself is characterised by the formation of papules and vesicles, which burst and discharge a serous fluid that will be found to produce stiffening in linen applications. This dries on the part, forming thin scales. If no improvement occur this condition becomes chronic.

Treatment.—In the acute and early stages soothing remedies must be applied, such as washing with thin oatmeal water and the application of an ointment such as the following :—

R Plumbi Acetatis gr. x
 Hyd. Subchloridi gr. x
 Vaseline ʒj
 Fiat ung.

This may be used at night-time to prevent the linen from adhering to the skin.

In the chronic form, the treatment consists of the removal of the scabs with oil and the use of a tar lotion, the best being Wright's liquor carbonis detergens, in the strength of ʒij to ʒviij of water.

Porrigo contagiosa, or contagious impetigo, is allied to eczema, but differs from it in some important points. It is very common in children, generally beginning on the scalp from some local cause, such as the irritation from pedicula or the scratch of a pin. A pustule is then formed at the seat of injury, which is broken, and the pus inoculates a fresh part of the skin, or the pus may be carried from one part to another by means of the finger when the child scratches. Soon large scabs are formed and the disease spreads rapidly, covering the whole head and blocking up the ears, often producing deafness.

The discharge is thick and purulent, and different altogether from the thin serous discharge of eczema. It is highly contagious.

The following is a typical case :—

18. E. G., æt. 13 months, was brought to me at the hospital March 3rd, 1874. Six months previously she had lost her mother, and had been constantly ailing since. The right ear and side of the head was one mass of porrigo. Ordered a bread poultice and a carbolic acid lotion, and ʒj of steel wine and of cod-liver oil three times a day, and a grey powder occasionally. March 10th.—Was much better. The ear looked much more healthy and cleaner. I ordered calamine ointment instead of poultices, and to go on with other treatment. She came to the hospital regularly, and on April 7th was discharged cured. I have found the *unguentum*

rubrum of the hospital pharmacopœia very useful in chronic cases.*

The treatment, it will be seen, consisted in getting off the scabs with a poultice, and destroying the action of the pus with carbolic acid and a mercurial ointment.

Erythema.—Various forms of this disease may be seen on the ear, but they are not of much importance to the aurist.

Erythema perino—chilblains—is common in children. The diagnosis is rendered easy by the presence of the same affection on the fingers and toes. It is best treated by constant application of a spirit lotion and warm clothing.

Herpes.—In the course of any of the acute inflammatory diseases it is not uncommon to see a sudden outburst of herpes at the margin of one of the orifices. The mouth is the one usually affected, but it not infrequently shows itself in the external auditory meatus, or indeed at any point where the mucous membrane meets the skin. By its presence in the meatus deafness may be caused, which, however, subsides on the bursting of the vesicles, after which no treatment is required beyond the application of a simple ointment.

Herpes Zoster or Shingles.—This disease is a neurosis affecting some portion of the nerve trunk, with or without a cutaneous eruption, corresponding to the peripheral extremity of the same nerve. It is usually seen upon the terminations, or the branches of the intercostal nerves; but it occasionally makes its appearance

* R Hydrargyri Bisulphureti (not officinal).

Hydrargyri Oxidi Rubri, āā gr. 6

Creasoti ℥ij.

Adipis ʒj

Misce.

in the neck, spreading upwards in the neighbourhood of the ear and on the ear itself, following the course of the ascending branches of the cervical plexus.

The outbreak, which consists of pearly vesicles on an uninfamed base running a definite course lasting only a few days, is often prefaced by severe neuralgic pains, which may last for weeks after all external traces have disappeared. Little treatment is needed during the course of the attack, but subcutaneous injection of morphia and the internal administration of quinine will be required to relieve the severe neuralgia.

Pruritus or "itching" is a troublesome ailment, upon which the aurist will be at times consulted. It chiefly occurs in nervous middle-aged or elderly females, and is very difficult of cure. It is to be observed for the most part in persons suffering from imperfect and weak circulation. The mucous membrane of the meatus is in some instances dry, but not invariably, as cases of undue secretion have also been noticed.

The tendency to scratch the part in order to relieve the extreme irritation only increases the mischief it is intended to allay. There is nothing to be seen on the skin outside the meatus, and the speculum reveals no alteration or change affecting the tympanic membrane.

The treatment should consist of soothing lotions and ointments containing opium, creasote, or hydrocyanic acid, and weak preparations of mercury. Benefit is said to be derived from strong lotions of nitrate of silver; and arsenic internally may be efficacious in obstinate cases.

Ichthyosis. — This congenital disease consists in a malformation of the skin in the form of an abnormal development of the epidermis and intense dryness. It

may cause an altered shape of the external ear, especially as regards the lobe—a fact remarked by the late Mr. Naylor.

The disease itself is incurable, but great benefit can be obtained by constant and prolonged maceration and the use of glycerine.

Lupus erythematosus.—The principal distinguishing characteristic is the appearance in its early stages of rough patches of a reddish colour, marked with small nodules of a greenish tint formed by serum being retained in the sebaceous glands. It usually first appears on the bridge of the nose, extending down each cheek, resembling the outline of a butterfly; or it may take the form of detached patches assailing the eyelids, nostrils, and lobes of the ears. It is rarely to be met with in persons who have not attained the age of puberty, and is more particularly observable in those of a scrofulous or phthisical diathesis.

Treatment.—In the earlier stages the local application of cod-liver oil, afterwards scarification, assisted by such internal remedies as cod-liver oil, iron, and quinine.

Erysipelas is frequently met with. The following is a case:—

19. E. S., æt. 54, came to the hospital November 10th with erysipelas over the whole of the right ear and side of the head. The meatus was nearly closed, and she was suffering from burning sensation of the skin together with great redness and swelling. She was ordered a brisk purgative, large doses of perchloride of iron, and a warm carbolic acid lotion to be very frequently syringed into the ear. As she could not sleep at night she was also ordered morphia. Under this treatment she got rapidly well.

The ear should not be exposed to air, but kept lightly

covered over. Starch powder dusted over the affected part with a camel's hair pencil is often very useful; at the same time the head must be kept cool. Erysipelas may be acute or chronic, more frequently the latter.

SYPHILITIC DISEASES are not uncommon. Grüber states that he has never met with a primary sore in any part of the ear. "Secondary eruptions are frequently seen; thus the point of insertion of the auricle and the lobule is most liable to a papular eruption, while other parts of the auricle most frequently show an exanthematous form of disease. Squamous eruptions are found on the auricle rather than in the meatus."*

The following cases of ear disease, occurring in patients with a syphilitic taint, are interesting:—

20. M. McM., æt. 25, came to the hospital March 31st, 1874. She had a syphilitic eruption on both ears, with an offensive discharge from the external meatus, the tympanic membranes, together with the walls of the canal, appeared to be ulcerated. Some time previously she had had a hard sore. This patient said that she "had been quite deaf for one month, and that her life was a misery to her." I ordered gr. viii of the iodide of potassium, with cinchona, three times a day, a nitric acid gargle, as her throat was in an unhealthy state, and a carbolic acid lotion for the ears. The Politzer air-bag was also regularly used, and in six weeks' time she lost all signs of the disease and heard perfectly well.

The next case I shall mention is one of much greater severity.

21. F. G., æt. 50, came to the hospital July 28th. Five years previously had syphilis badly. Had been deaf ever since, and was getting rapidly worse. The membranes were very white in colour and thickened. She could hear a watch in contact with her left ear; but not at all with the right ear. Some difficulty was experienced in using the Politzer bag, as the nose was deformed from syphilitic disease. Large doses of iodide of potassium were

* Burnett. "A Treatise on the Ear," p. 232.

given. On August 4th her hearing had improved considerably (for she heard the watch three inches off on the left side, and in contact on the right); she went on improving slowly in power of hearing as her general health improved. Her throat was very troublesome for some considerable time, but she never had any discharge from, or pain in her ears. The doses of the iodide were gradually increased, and the Politzer air-bag was used twice a week.

22. E. N., æt. 42, a carpenter, came to me at the hospital, December, 1876. He had a hectic appearance, quick pulse, and other symptoms of severe constitutional disturbance. Two-thirds of the auricle of the left ear had sloughed away, leaving a large round hole, in which, however, the external auditory meatus could not be distinguished. There was a large quantity of very offensive discharge, and he described the pain as very severe. This serious state of disease had commenced, he said, three months previously, from pricking his ear with a pin; and since that time he had been treated with different tonics, and a great variety of lotions and ointments, without any relief; in fact, the ulceration was progressing all the time. From the condition and history of the disease, I diagnosed a syphilitic taint, and prescribed five grains of iodide of potassium with bark three times a day. The ulceration was thoroughly cleaned by poultices, and then dressed with an ointment composed of a drachm of *unguentum hydrargyri nitratis* with five drachms of zinc ointment. Rapid improvement took place, and in three weeks the sore had quite healed, leaving a respectable looking ear, although, of course, there was much loss of tissue. During the treatment, the external meatus was kept open with pieces of lint; and when he left the hospital, although the external meatus was very small, yet the hearing was good.

This case illustrates how a local disease in a patient with syphilitic taint may resist all ordinary treatment until the specific nature of the case is recognised; and shows how soon such a case is relieved when suitable remedies are employed. This man might have been saved the loss of part of his ear, and also a dangerous illness, if the syphilitic features of the case had been diagnosed at an earlier period.

CONDYLOMATA around the orifice of the meatus are frequently found.

The employment of mercury in some severe forms of secondary syphilis is necessary, my colleague, Mr. James Lane, says*: "There are, I think, two classes of patients in which the abstention from mercury may be advisable; first, those who are in sound health and capable of throwing off the morbid influence without assistance; and secondly, those in broken-down health, or in whom there is an evident strumous or consumptive tendency, which may render it desirable, if possible, to dispense with a mercurial course. In both these classes, however, should the symptoms become more severe, mercury should unhesitatingly be given, and it will often be of the most signal service."

* "Lectures on Syphilis," delivered at the Harveian Society, 1878.

After this chapter was in the press, Dr. Victor Bremer, of Copenhagen, kindly sent me his notes ("Om Behandlingen af Exostoser i Oregangen") of a case of double Exostosis, in which he operated successfully in one ear, February 19th, 1878, by means of the dental engine. He recommends for the after treatment of granulations, "the application of pin-shaped pieces of '*Laminaria digitata*'" (Særtryk af "Hospitals-Tidende," Nr. 2, 1879).

CHAPTER VI.

ACUTE CATARRHAL AND SUPPURATIVE
INFLAMMATION OF THE MIDDLE EAR.

AURAL CATARRH has been divided by authors into various forms of acute and chronic inflammation of the mucous membrane of the ear passages.

Toynbee includes the external meatus, and in his book mentions simple chronic inflammation of the dermoid meatus, chronic catarrhal inflammation of the dermoid meatus, and catarrhal inflammation of the dermoid layer of the external meatus, with caries of the posterior wall, &c., &c., &c.

Von Tröltsch and others, however, object to catarrhal inflammation being ascribed to disease of the external meatus, for he says there cannot be catarrh where there is no mucous membrane. This authority makes the following division:—1. Simple acute catarrh; 2. Simple chronic catarrh, divided into dry and moist, &c. Mr. Hinton justly observes in a note of his translation of Von Tröltsch:* “In attempting to better demonstrate the extreme variety in which the chronic catarrhal process shows itself in the middle ear, by representing certain prominent manifestations of disease in apparently separate groups, I have not meant to establish different forms of disease, and I would lay special stress upon the fact that the three forms alluded to occur much less fre-

* “The Surgical Diseases of the Ear,” by Professor von Tröltsch, translated by James Hinton, pp. 48 and 53.

quently alone than combined in various ways, and the one passing into the other." In Holmes' "System of Surgery"* Hinton himself gives us acute and chronic inflammation of the mucous membrane of the tympanum. And lastly, my predecessor, the late Dr. Peter Allen, in his work on Aural Catarrh, says:—†

"Aural catarrh must not therefore be considered as an affection in which the mucous membrane of the cavity of the tympanum and Eustachian tube is solely involved, but it is applied also to catarrhal inflammation of those structures which are lined with a continuation of the mucous membrane of the tympanum, as well as to certain forms of diffuse inflammation of the dermoid layer of the meatus. Some writers restrict the term catarrhal inflammation to mucous membrane only. There are, however, high authorities who do include under it inflammatory conditions of the external walls of the meatus. I find it convenient to designate this very frequent disorder in childhood as catarrhal, because we cannot distinguish whether the inflammation from catching cold may not have begun in the tympanic structures on the inner side of the drum head, and then passed onwards and outwards, by continuity of surface, to the meatus. We may, therefore, I think, quite as correctly name this condition catarrhal or dermoid. If the inflammation from within or without stopped at the margin of the membrana tympani, we ought to define the affection as belonging either to one or the other structure; but, as we cannot be so acute in our diagnosis as to be able to detect the moment when it ceases to advance, either on the inside or the outside, any sharply restricted definitions are in practice useless."

* Vol. 3, p. 166.

† "On Aural Catarrh," p. 24.

From these different opinions it will be seen how difficult it is to define clearly any one form of aural catarrh; while in practice they are constantly found mixed in various ways one with another. While speaking clinically, I shall endeavour to follow as closely as possible the following division of the subject:—

1. (a). Acute catarrhal inflammation of the middle ear; (b). Acute suppurative inflammation.
2. Sub-acute and chronic catarrhal inflammation.
3. Chronic non-suppurative inflammation.
4. Chronic suppurative inflammation, and the various forms of otorrhœa.
5. The results of suppurative inflammation.

Practically these divisions are useless, and we should be careful not to jump to conclusions, and say, for instance, “this is a case of chronic catarrhal inflammation of the dermoid meatus, and must therefore be treated in such and such a way.” In fact, we must not treat the disease, but simply the symptoms which each individual case presents to us.

I purpose to record in illustration of what I have just said, a number of cases and the treatment which I have found useful.

ACUTE CATARRHAL INFLAMMATION.—I will begin with a malady which most of us have experienced—viz., earache, and acute catarrh of the middle ear. In young children it is very frequently met with: the child at first gets restless, refuses food, cries out, and is evidently suffering intense pain; castor-oil or grey powder is generally administered, the gums are carefully lanced; or may be the stomach is well poulticed, without, it is needless to say, any good effect. In a few days, however, a discharge is noticed from the ear, and the child,

in the majority of cases, gets well, but occasionally the symptoms increase, the little patient either becomes more or less deaf, or dies from *so called* "teething!" I have seen a great many cases of this kind; in fact, one of my own children suffering in this way first drew my attention to the subject. It is nearly always brought on from cold, is generally confined to one ear (and this is an important fact), the child refuses invariably to rest its head on the affected side (a circumstance which ought to draw attention at once to the seat of the malady).

The treatment I recommend is the frequent pouring (not syringing) of warm water into the external meatus. This, as a rule, gives immediate relief, and the child will go to sleep. Perhaps a leech in front of the tragus will be found necessary in some cases. Mild purgatives should also be administered.

CONVULSIONS.—Dr. Hughlings Jackson says that "in all cases in which there is or has been discharge from the ear, especially when there is also pain in many branches of the fifth nerve; above all, if palsy of the portio dura nerve comes on, we should fear one of two things: (1), cerebral or cerebellar abscess; or (2), meningitis. We must not decide unless there are general symptoms—also, *e.g.*, increase of temperature, constipation, vomiting, and stupor, for discharge from the ear is not infrequently attended by chronic convulsions, occurring at intervals for years (epilepsy); and the fit we are consulted for may be the first of such a series."*

In all forms of acute catarrh the tympanic membrane (as one would expect from increased vascularity) will be

* Reynolds' "System of Medicine" (2nd Edition), vol. 2, p. 266.

found to be either pink, red, or copper-coloured, according to the stage or severity of the attack. Children when they grow a little older suffer from earache arising from chronic inflammation of the external meatus. This I shall notice on another occasion.

I will now cite a case of acute catarrh of the middle ear and Eustachian tubes after sore-throat.

23. J. M., Esq., æt. 25, sent to consult me by Mr. Owen (Aug. 10th, 1874). Had been slightly deaf for three weeks from cold, but two days before had got a sore-throat, after which his ears began to ache. He was suffering intense agony over both sides of his head, aggravated very much when he swallowed, so much so that he was afraid to eat. The whole of the naso-pharyngeal mucous membrane was very much congested. He had great tenderness over the mastoid process on both sides; could not hear my watch with the left ear, but heard it in contact with the right. His face was flushed; he had a quick pulse and hot skin. Both tympanic membranes looked bright red in colour, and the right external auditory meatus was very tender to the touch; there was no sign at present of bulging of either membrane; the Eustachian tubes were impervious. Tinnitus aurium was present in both ears, very severe and distressing in the right. Six leeches were ordered in front of the tragus of each ear, with a saline mixture with morphia, and a brisk purge. The next day great improvement was felt, the pain had almost gone, but the tinnitus was still present. The Politzer bag was used, and air passed easily through the Eustachian tubes. A feeling of great relief was immediately experienced, and the tinnitus aurium almost stopped. The tympanic membranes had lost some of their redness, and looked more healthy. The throat was painted with a solution of nitrate of silver, 10 grs. to the ounce. Six more leeches were applied in front of the right ear, as there was still tenderness felt in the external meatus and on the side of the face. This gave immediate relief. The Politzer bag was used daily with very good effect; a considerable quantity of fluid was heard bubbling as the air passed into the tympanum on both sides. The paint to the throat was continued, and iodine liniment applied daily behind the ears. This treatment was continued daily for a fortnight, the mucous membrane of the throat,

&c., became less and less congested, the fluid gradually disappeared from his ears, and he rapidly regained his health and hearing.

Von Tröltsch* recommends that, when applying leeches, the ear should be carefully stopped up with cotton-wool, and the bites should afterwards be covered with plaster, as erysipelas might otherwise occur, from the wounds being poisoned by the otorrhœa. When leeches are indicated they should be used freely, two or three are of no use whatever.

Weber-Liel has lately recommended a cold compress to be applied frequently over the seat of pain, and to be changed before it has time to get warm,† in place of leeching.

Acute non-suppurative catarrh, or, as Von Tröltsch calls it, simple acute catarrh of the ear,‡ is characterised by the rapid appearance of hyperæmia and swelling of the entire mucous tract of the middle ear, with considerable increase of secretion, which, however, still preserves its mucous character. This state is generally associated with other catarrhal diseases, influenza, pharyngeal or bronchial catarrh, or even pneumonia. Syphilitic disease of the throat is a not uncommon starting point for it. The prognosis is so far favourable, that perforation of the membrane occurs somewhat rarely, and then nearly always during violent sneezing or blowing the nose. The hearing of the patient can be very considerably improved by early local treatment ;

* "Surgical Diseases of the Ear," p. 23.

† For further particulars as to the use of the cold compress, see an article by Dr. William Winternitz in the "Practitioner" for August, 1878.

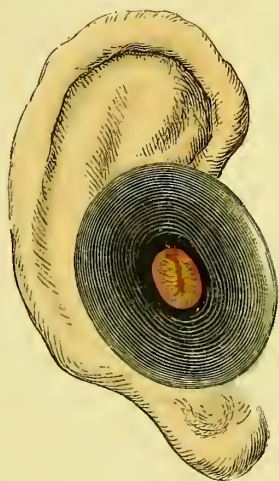
‡ "Diseases of the Ear," by Dr. von Tröltsch, translated by James Hinton, M.R.C.S., p. 48.

but by such an acute attack the foundation is not unfrequently laid for insidious aural catarrh, since thickening of the mucous membrane of the Eustachian tube and tympanum, abnormal bands of adhesion, &c., are very apt to remain after it. The main point is to prevent the development of such conditions by removing as soon as possible the mucus accumulated in the ear. He recommends early incision of the membrane, and "in milder cases air douches (catheterism or Politzer's process) to provide a mode of escape for the mucus present, and to allow the adhering surfaces of mucous membrane in the Eustachian tube and the tympanum to remain separated from one another."

I shall fully discuss paracentesis of the membrana tympani when I speak of chronic non-suppurative inflammation.

MYRINGITIS.—I have purposely avoided as much as possible dividing acute aural catarrh into different forms, for practically its division is of very little importance. The drum head itself may be alone implicated (myringitis), giving rise to deep-seated tearing pain in the ear, with a feeling of throbbing and fulness, and severe tinnitus aurium. These symptoms are more or less severe; bleeding from the ear often takes place, which may prove beneficial, or the case may go on to suppuration and perforation, and then is oftentimes followed by thickening of the membrane.

24. H. P., æt. 18, came to the hospital with acute inflammation of the tympanic membrane of the right ear, which came on after a cold bath. He had been slightly deaf for three weeks, but three days before felt violent pain in the right ear; he described it as feeling stuffed up, and he felt a beating kind of pain deep down in the ear; he also had severe tinnitus. He could hear my watch in contact. The drum head was of a bright pink colour,



ACUTE INFLAMMATION OF MEMBRANA TYMPANI.

(*Myringitis*).



but the external meatus was perfectly healthy. Two leeches were applied in front of the tragus, and a warm weak solution of carbolic acid was frequently poured into the ear. The leeches gave immediate relief, the membrane recovered from its highly vascular state, the slight discharge ceased, and in ten days' time he was perfectly well.

This is said to be a very rare disease, and Grüber states that as an idiopathic affection it is of rare occurrence; as a secondary event very frequent; and Burnett* remarks that he has assured himself that the tympanum is free from disease in all such cases as could be termed myringitis, and he is disposed to consider it an inflammation usually, if not always, of the dermoid layer of the drum head.

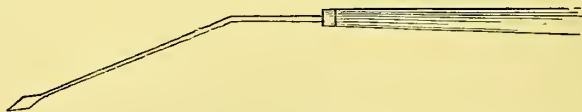
Cases are occasionally described in which the suppuration is said to be limited in extent, and these are called abscesses of the membrana tympani, and are usually found between the mucous and fibrous layers of the drum head. I regard this as a useless subdivision of acute suppuration of the middle ear, for the symptoms and treatment are precisely the same; and the inflammation has in every case I have seen extended beyond the drum head, usually internally to the tympanum, but sometimes externally to the external meatus.

ACUTE SUPPURATIVE INFLAMMATION.—In this disease, if bulging of the membrane is present, paracentesis should be resorted to at once to let out the fluid.† This is especially necessary in acute inflammation following scarlet fever, measles, &c.; for not only the cavity of the tympanum, but the mastoid cells also are often

* "A Treatise on the Ear," by C. H. Burnett, M.D., of Philadelphia.

† "Surgical Diseases of the Ear," p. 23.

filled with puriform fluid. In this operation the head should be well supported, a good light should be thrown on the membrane through a silver ear speculum; and the puncture should be carefully made in the posterior and inferior portion of the membrana tympani, for here we shall nearly always find the greatest amount of bulging.*



PARACENTESIS KNIFE.

Sometimes the pus makes its way through the membrane, and, if attended to early, no bad results take place, as with care the perforation will generally heal; and if an aperture remains it does not necessarily cause deafness, for even when a large hole in the drum head is left, the hearing power may remain very good. Only the other day a child was brought to me from the country, who had lost nearly the whole of his right tympanic membrane after scarlet fever, yet his hearing was nearly perfect. However, if treatment is neglected, a very different result may occur, as for instance, otorrhœa following one of the zymotic diseases, in which cases the parents so frequently say they have been told that "the child will grow out of it." One might imagine that for cleanliness' sake alone they would endeavour to get rid of the foul discharge, instead of allowing it to feed for months or years on the delicate structures of

* For further information on this subject I would refer the reader to a paper by Dr. Cassells, of Glasgow, published in the "Edinburgh Medical Journal" for March, 1876, and kindly sent to me by the author.

the ear. But such is not the case, and in some of these patients very serious results to health and hearing occur.

I shall in the first place give cases where from early treatment little or no mischief has taken place; and shall then bring forward a few others which have assumed a serious character in consequence of this neglect.

25. D. S., æt. 40, came to me at the hospital with severe pain in the right ear. He stated that the week previously "he had got wet through in the rain," and since that time the pain in his ear had been increasing. About three days ago he was in "great agony." He then poulticed his ear every hour with linseed poultices for two days until something burst, and some thick matter came away. He was very much relieved by this, but still suffered a good deal of pain; the discharge from his ear was very thick, extremely offensive, and continually running. He was unable to hear my watch in contact. Upon examination with the speculum I found a very large perforation in the membrana tympani, through which the abscess had burst. As there was still a good deal of tenderness, I ordered six leeches to be applied, the ear to be gently syringed every other hour with warm water, and the poultices to be discontinued. The next day the patient was much better, so I prescribed a weak solution of carbolic acid—gr. i to the ounce—to be poured (warm) into the ear four times a day after the syringe had been used with warm water. He soon got much better, and the discharge lost its offensive character. The lotion was then changed to gr. i of acetate of lead to the ounce. He was directed also to draw up through his nose a warm solution of bicarbonate of soda (a teaspoonful to the pint of water). By this means the fluid passed up the Eustachian tube through the perforation, carrying with it the discharge into the external meatus, thus cleansing the ear from the inside. He was told also "to hold his nose and blow" when he poured into his ear the lead lotion. Bubbles of air thus pass in through the perforation in the membrane, and drops of fluid replace them. By this means he attacked the malady from without, as he had by the other method from within. Under this treatment the perforation got rapidly smaller, his hearing improved, the discharge gradually ceased, and at length, in three weeks' time, the aper-

ture closed, and his hearing returned as perfect as it was before the attack.

This man was naturally healthy, which was of course greatly in his favour. If the parts are kept constantly clean in these cases of recent rupture, the membrane will generally heal in as satisfactory a manner as it did in this case.* In cases of otorrhœa where there is a discharge of thick pus, it is absolutely necessary that the syringe should be used at least three times a day, in order that the lotions can affect the diseased membrane with benefit.†

If the drum head, when in a healthy state, be punctured, the puncture will rapidly close up again; it is most difficult to keep it open. So, if the membrane is ruptured from an abscess bursting through it, the surgeon's great aim should be to get it into a healthy condition; and if that condition be gained, it will heal up almost as rapidly as when an incision is made. This is more readily accounted for when we remember that, in almost all cases of perforation from acute catarrh, a longitudinal slit, and not a round hole, is first made in the membrana tympani. But if the discharge is allowed to continue for some time, a round orifice is formed from constant passage of the fluid, and hence we have far greater difficulty in effecting a closure.

The symptoms of these cases of acute aural catarrh vary very slightly one from another, as I have already pointed out; but the above case is one very commonly met with. Occasionally we find that one astringent

* See also Cases, page 124.

† Sir William Wilde truly says: "So long as otorrhœa is present, we never can tell how, when, or where it may end, or what it may lead to."

proves of much greater service than another; it will therefore be found beneficial to change the lotion from acetate of lead to sulphate of zinc, and so on.

Politzer says on this subject: "In cases of acute purulent catarrh of the membrana tympani, weak solutions of the preparations of zinc and lead are very efficacious. The preparations of lead frequently act quicker after a zinc solution has been used for a few previous days. Perchloride of iron, alumina, and nitrate of silver are not generally adapted to acute cases. In cases of purulent catarrh with a small perforation of the membrana tympani, a solution of lead dropped in is very useful. An extremely favourable result has in some cases been brought about by the use of powdered alum. Most of these preparations lose their favourable action after being applied for too long a time without being suspended."

26. W. H., æt. 8, was sent up from Esher March 2nd, to consult me. He had been deaf five years, and had had during the whole of that time a constant offensive discharge from both ears. I found that both membranes were perforated. For six months he had been gradually losing his power of speech, so that when he was admitted into the hospital under my care, he was almost deaf and dumb, and was not able to hear my watch in contact with either ear. He had never been treated in any way for his deafness. With the aid of various and often changed astringent applications, the mucous surfaces regained a healthy condition and the discharge ceased. By constant care for two months, he was able to talk and hear very well.

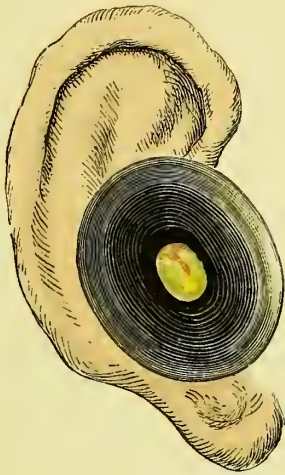
Supposing, however, that cases of the more serious forms of inflammation have been allowed to take their own course, the result in the majority of instances is that in 99 cases out of 100 mischief results. Thickening or perforation of the membrana tympani; chronic inflammation of the mucous membrane of the tympanum

and constant otorrhœa; injury, or perhaps total destruction of the ossicles; extension of the inflammatory process to the brain, &c., &c., &c., may supervene. After fevers a sanguineous fluid may fill up the cavity of the tympanum, perhaps causing complete disorganisation and total deafness. One of the most common cases that occurs is perforation from scarlet fever. These cases often do very well if the otorrhœa is at once checked (by the means that I have already suggested), for the mucous membrane is readily restored to a state of health by such treatment; after which there is a fair chance of healing up the orifice in the tympanic membrane by the application of nitrate of silver, or other similar remedies. If an attempt be made to close it before the discharge has ceased, more harm than good is done, for the pus is shut in, and a sort of artificial abscess is formed.

Some time ago there was a most interesting case in the Victoria ward of St. Mary's, which well shows the ravages made by scarlet fever in the middle ear.

27. It is that of a girl, *æt.* 17, under the care of Dr. Broadbent, who kindly asked me to see her. Fifteen years ago she had a very severe attack of scarlet fever. Her brother and sister, who took the disease at the same time, both died, and she was left deaf and dumb. She had not been born in that condition, although her father and mother were first cousins. One might have been led to attribute her affliction to parental consanguinity; had it not been that, before the attack of fever, she could hear perfectly, and was beginning to talk tolerably well. But she became incurably deaf, and soon lost all power of speech.

28. The other day, a lady from America, brought her son, *æt.* 12, to consult me. He had suffered from scarlatina some four years previously; he was totally deaf, but as he had learnt to speak at eight years old fairly well, he had not yet forgotten how to talk.



MUCO-PURULENT COLLECTION IN CAVITY OF TYMPANUM.



The first thing the mother did was to produce a little bottle containing the ossicles, the malleus, stapes, and incus, all in a perfect state of preservation! She said they had come away with the discharge during the fever. I need hardly say that he was hopelessly deaf.

29. A. E. A., æt. 3, was brought to the hospital February, 1878, totally deaf in both ears. Her mother stated that a year ago the child had had a severe attack of scarlet fever, with great discharge from both ears, and that four or five "little bones" came away from her ears.

I cannot help thinking that in most of these cases if more energetic local measures had been promptly adopted, total deafness at any rate might have been avoided. Paracentesis of the membrana tympani is, in some of these cases, most useful; and Roosa recommends that a cataract needle should be passed through the posterior membrane, in any case, whether bulging is seen or not, when the use of leeches does not markedly diminish the pain within a few hours.

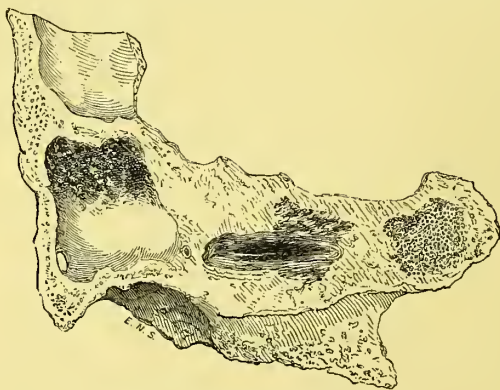
But to return to the condition of the deaf and dumb girl, case 27. Immediately behind the left concha, and hidden by it, was a round opening, which led, no doubt, into the mastoid cells. It was large enough to admit a peppercorn. The Eustachian tube was completely closed on that side, so that air could not be passed by that channel through the unnatural opening. One was led, therefore, to infer that the abscess of the tympanum, which made its way through the mastoid cells, had been followed by sufficient chronic inflammation to cause a permanent blocking of the Eustachian tube.

Whilst examining this case, I could not but think of Berger, the Danish surgeon, who died of meningitis, after having had his mastoid cells opened from the exterior to admit air into the tympanum, he having been

previously deaf for some years. Nature has the advantage over the surgeon in effecting a permanent opening into the mastoid cells, for she works quietly and discreetly from the interior, whilst he commences from the outside. Certainly the surgeon in his heroic treatment cannot always be said to act discreetly.

I may mention that this patient, Case 27, died a few days ago, from tubercular peritonitis. I have been fortunate enough, by the kind assistance of Dr. Mahomed, to record the exact condition observable after death in this deaf and dumb girl.

The two ears presented similar changes. The tympanic membranes were entirely destroyed. The tympanic cavities were much enlarged by caries of their walls, principally backwards and downwards, especially towards the mastoid cells, which appeared plugged by cheesy material. The internal ear was also disorganised; in fact, all the structures in the latter organ seemed destroyed; the semi-circular canals and cochlea being plugged with inflammatory products, so that their out-



SECTION OF TEMPORAL BONE (Case No. 27).

line even could not be traced. The Eustachian tubes were both also completely obstructed. In the right ear, the tube could be seen in transverse section; in the left, in longitudinal. In the right ear, in which the opening between the mastoid and external ear had closed some years previously to death, the cavity was filled with cheesy pus, and was evidently in a state of quiescence; in the left ear an opening was still visible, close to the mastoid process. The cavity of the tympanum was divided into two parts: the anterior, plugged by cheesy material, and quiescent; the posterior, lined by pyogenic membrane, from which the discharge at the time of death originated. There was also extensive disease of the temporal bone.

One could not help remarking in attending to this poor girl, the disadvantages that those of the deaf and dumb are under who have been taught to communicate only by means of the finger alphabet and signs. This patient, although very intelligent, had learnt this method, and consequently could only make herself thoroughly understood to those few who happened to be able to understand and use the necessary signs; whereas by the German system of lip-reading, the deaf and so-called dumb are actually taught to speak with clear and not unpleasant articulation, and not only to speak, but to understand the speech of others. Thus a child of ordinary ability can be taught, in the course of a few years, to speak with a tolerable degree of fluency, and to follow by watching the lips of other speakers any conversation which may be carried on, provided the speaking is clear and distinct. I am convinced of the immense advantage that this system of articulation and lip-reading has over the older method. I mention it

here as it is a subject which has not yet met with the attention it deserves in this country.*

Some attacks of acute aural catarrh seem to come on suddenly without apparently any sufficient cause, and it is almost impossible to account for their origin. Dr. Cassels, in a paper lately published,† describes an acute inflammation of the ear, which he attributes to the admixture of a minute quantity of sewer-gas with the air, too minute even to be perceived by the sense of smell, giving rise to a state of general *malaise*, and that this brings about serious disease in the ears. He says: "I freely incised each membrana tympani, and thereby gave exit to much clear serous fluid, with marked and almost instantaneous relief to all the previous suffering. This fluid, always serous-like in appearance, continued to drain away very freely for several days, to the extent of about eight fluid ounces in all."

I have no experience myself in the matter, as I have never seen a case of the kind where I could trace the disease to this cause.

Quinine in large doses sometimes causes an acute inflammation of the mucous membrane of the tympanum and Eustachian tubes. The following is a case in point:—

30. The Rev. T. P. came to consult me in June, 1874. A short time before he was taken ill in Rome with fever, and was given large doses of sulphate of quinine. Shortly afterwards, singing in the ears and deafness came on, which had been gradually increasing. He had a slight discharge, and a great deal of pain in

* There are many schools already where this system is thoroughly taught, but there is room for many more. There is an admirable institution lately started for training teachers.

† "On Sewer-Gas and Ear Disease," Edinburgh Medical Journal, April, 1878.

both ears. He could not hear the watch in contact on either side. The mucous membrane of the throat was very congested ; the Eustachian tubes were completely closed ; and both tympanic membranes looked bright red in colour. After a little perseverance I was able to open both Eustachian tubes by means of Politzer's air-bag. His hearing immediately improved to such an extent that he could hear my watch at the distance of six inches, and his recovery was completed by the use of a weak carbolic acid lotion to the ears, an application of tinct. ferri. perch. \mathfrak{z} i to the \mathfrak{z} i of water for the throat, and the discontinuance of the quinine.

Roosa, in writing on this subject, says: "I am inclined to suspect the effect of quinine upon the ear is sometimes an inflammation of the conducting portions of the ear as well as of the acoustic nerve or labyrinth. We have long known of the latter effect, but the former has not been often observed. I have been convinced by experience that it has a peculiar power of congesting the auditory apparatus.*

The external meatus itself may be diseased (otitis externa). This is most frequently met with in children after scarlet fever, small-pox, &c., &c., and it is often brought on from bathing in cold water.

* "Treatise on the Diseases of the Ear," by Dr. B. St. John Roosa, M.A., M.D., p. 504.

CHAPTER VII.

SUB-ACUTE AND CHRONIC CATARRHAL
INFLAMMATION.

CHRONIC aural catarrh is by far the most frequent cause of deafness. In the last chapter I pointed out the great variety of cases that may be met with, and how difficult it is to define clearly the various forms of this disease; especially when we remember some of those indefinite cases in which it is hard to say where the acute inflammation ends and the chronic form begins.

I will commence with the more simple form of mucous catarrh, first taking cases that can be overcome by Politzer's process, &c., and then going on with those not so recent (or, perhaps, of long standing) where it is necessary to inject fluids, &c., into the tympanum to cope successfully with excessive secretion, swollen tissues, or hypertrophied mucous membrane; and I shall describe more fully chronic suppurative aural catarrh when we come to the important subject of otorrhœa.

It is remarkable how often children suffer from simple mucous catarrh, and even more astonishing how large the number is of those who are permitted to neglect all remedial measures until they become perfectly deaf.

The most successful results are obtained from early treatment. As I have said before, it is the most important to impress this constantly on the minds of people now-a-days, that there is a generally received notion that children as they grow older or stronger, or

less delicate, &c., &c., will gradually get rid of their difficulty of hearing. Very slight pain is experienced by these patients, and they are, therefore, I suppose, led to believe that no serious consequences can result; whereas, as a matter of fact, they generally get deafer and deafer from the ever-increasing disease. The mucus being permitted to accumulate and harden, the drum-head becomes thickened, or the ossicles adhere together and irreparable mischief is produced.

Another reason why this state of things is often allowed to go on in children is from a general belief on the part of parents that the child, instead of being hard of hearing, is absent or stupid. Most children are said to hear more than they are wished to hear, and it is absurd to suppose that any are voluntarily deaf. Many cases are recorded in which serious consequences have taken place from this mistaken notion. For instance, a case is related in Holmes's "System of Surgery"* of a youth who died of caries of the petrous bone and abscess in the cerebrum, and in whom the symptoms of aural disease dated from early life, from his father being in the habit of boxing his ears "for inattention."

31. The first case that occurs to me is that of Master R., æt. 9, sent to consult me by Dr. Broadbent. He had been in a delicate state of health for a considerable time, and had suffered from deafness for two years, which had become gradually worse, especially of late, so that he could hardly hear my watch in contact with either ear. His throat was very relaxed, his tonsils enlarged, and his general state of health very bad. He was very absent in manner, and could not hear general conversation. He snored in his sleep and breathed heavily, and was said "to talk through his nose."

* Vol. 3, p. 171.

In this case the Politzer bag afforded great relief, and it was regularly used twice a week. His hearing quickly improved, for after three weeks' treatment he could hear sounds 12 inches off on both sides. He derived great benefit at the same time from taking \bar{z} i each of cod-liver oil and steel wine three times a day. His throat was painted daily with \bar{z} i of tinct. ferri perchlo. to \bar{z} i of water. He then left for Germany for six months, but on his return came to consult me again, when his hearing distance was four inches left, seven inches right. The same treatment was again pursued, and in a very short time his hearing distance was five or six yards with both ears, or, in other words he could hear perfectly.

This case is typical of a class which is very common in practice, the result of treatment varying, however, considerably, some taking a long time to deal with successfully, while others are cured by one application of the bag. It is important at the same time to remember that "half the battle" depends upon attention to the general health of the patient, and in relieving the congested mucous membrane by astringent applications to the throat.

As a rule these children's cases are very easily cured, if treated early, but if neglected (as I have so often repeated) they run on to obstinate and incurable deafness. If parents were more alive to these facts, difficulty of hearing would be far less common than it is.

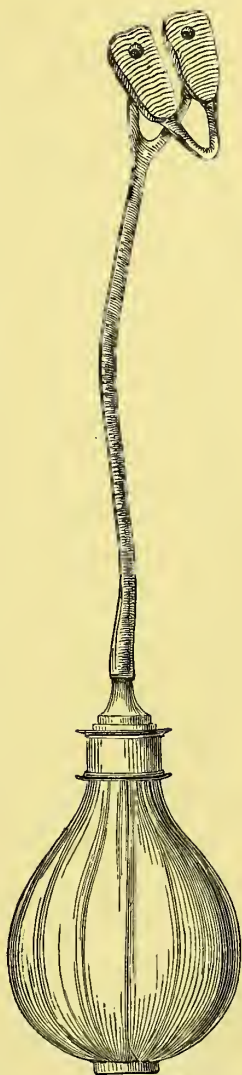
The following is an interesting case, and one that is not unfrequently met with:—

32. M. L., æt. 14, came to consult me at the hospital. She had been ailing and getting gradually deaf for two years, from the time she began to menstruate; was very anæmic; had no appetite; was constipated and suffered from a very relaxed state of mucous membrane of the throat. She was very deaf, and could not hear my watch in contact with either ear. For the last six months the menstrual periods had ceased, and from that time her deafness had got rapidly worse. I prescribed the syrup of the iodide

of iron, and painted her throat occasionally with nitrate of silver, 2 grs. to the $\frac{3}{4}$; and, as in the last case, frequently used the Politzer bag. This treatment was continued for three months. Her general health was completely restored; and when I last saw her at the hospital she could hear perfectly.

And now a few words as to the use of the Politzer bag. This useful instrument was invented by Dr. Adam Politzer, of Vienna; it has rendered the Eustachian catheter unnecessary in a great number of cases, and moreover it is much more easily used than the latter instrument. I prefer the Politzer bag with Allen's nasal pad attached, and find patients submit to this well, for it is much less disagreeable to them than having a tube inserted half an inch into the anterior nares and pressure made with the fingers on both sides of the nose.

By the use of this instrument currents of air may be blown into the pharyngeal cavities, and this will force the warm air, therein contained, to enter and pass through both Eustachian tubes into the tym-



POLITZER'S AIR-BAG WITH ALLEN'S
NASAL PAD.

panum. The act of swallowing opens the tubes, and the compressed stream of air is sufficient to overcome any moderate obstruction that may be present. When the resistance to the full entry of air is not great the patient feels suddenly a considerable pressure in the drum, and a loud noise is heard. Hundreds of cases which formerly escaped efficient local treatment we are now enabled to relieve or cure by the help of this most excellent substitute for the catheter. In young children it is not necessary for them to swallow at the same time that the bag is used, and when they are very young it will be found quite sufficient for every purpose (as Hinton first suggested) to use a piece of india-rubber tubing, blowing air from your own lungs instead of using the bag—a proceeding quite as efficacious and not so likely to frighten them.

The Politzer bag may be used with too much force, and this is especially likely to take place if the patient is allowed to practise its use heedlessly on himself.

33. A medical man, Dr. S., came to consult me a short time since with acute pain, and almost a total loss of hearing in the left ear, from using Politzer's bag with considerable violence. He eventually quite recovered his hearing, from adopting the same treatment as recommended in the next case, in which the mischief arose from trying Valsalva's method incautiously.

34. Mr. B., a gentleman living in the country, completely deaf from childhood in the left ear, and lately suffering from slight deafness in the right, was recommended by his medical attendant to blow air forcibly, by Valsalva's method, into his ear. On one occasion, as he was unable to get any air through the Eustachian tube, he went on blowing until suddenly the air rushed through the tube with great force, causing acute pain in the right ear and leaving him very deaf. The noise in his ear at the same time became so loud and distressing that he talked about committing suicide. He came to London to try and get relief, and was sent to see me by Mr. Tapson. I found him to be in a highly ner-

vous state ; he said the tremendous roaring in his right ear prevented sleep, and he was so exceedingly deaf that it was necessary, to carry on conversation, to write down on paper what was said to him. I considered that the force used had caused very considerable congestion of the blood vessels, with perhaps slight effusion into the internal ear. When I saw him the membrana tympani still looked red, but all pain had ceased. He was leeches freely and blisters were applied behind the ear, and purgative medicines were ordered.* The effect of this treatment was highly satisfactory, as he in a short time regained his hearing and almost completely got rid of the noise in his ear.

The vascular connections between the tympanum and labyrinth have lately been traced by Professor Politzer and others. The result thereof shows how hyperæmia of the middle ear may easily extend to the labyrinth.

Since this was written a valuable paper by Professor Grüber has been published† “On a New Method of making Pervious the Eustachian Tube and of Inflating the Tympanum.”

The details of the method are as follows :—

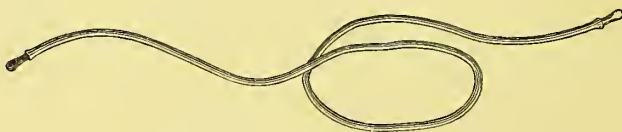
The operator stands, or sits at his convenience, face to face with the patient. The end of the nozzle-piece of a rubber bag, which the operator grasps in his hand, is introduced into the inferior nasal meatus of the patient for about half an inch, and the operator at once hermetically closes the nostrils on the nozzle-piece of the bag with the fore and middle finger of his other hand, and while the patient at the word of command pronounces one of the syllables (*hack, heck, hick, hock*,

* With regard to the treatment by counter-irritation, &c., see page 181, “Remarks on Case of Injury to Head.”

† “Medical Times and Gazette,” January 1st, 1876, by Professor Joseph Grüber, M.D., Aural Surgeon to the Imperial General Hospital of Vienna. See also an interesting paper on the “Vocal Method of Inflating the Tympanum,” by H. H. Clutton, F.R.C.S., St. Thomas’s Hospital Reports for 1877, vol. 8.

huck, hek), the bag is squeezed. Thereupon the air passes with distinctly perceptible noise through the tube into the cavity of the tympanum.

In chronic aural catarrh, when air is forced through the Eustachian tube and tympanum and impinges on the tympanic membrane, a peculiar "thud" is heard through the india-rubber tube, which has erroneously been termed the otoscope, but now better named the diagnostic or auscultation tube.



DIAGNOSTIC OR AUSCULTATION TUBE.

In using this instrument, which is usually made of black india-rubber about 12 or 18 inches long, one end should rest in the surgeon's ear, the other in the ear we wish to examine.

If fluid is present a gurgling sound is heard, while if the membrane is perforated there is a remarkable whistling noise, perceptible through the tube. Practice alone enables the surgeon to distinguish these various sounds.

Some children who may be perfectly well in their general health (unlike the cases I have given) nevertheless suffer from chronic catarrh. They breathe heavily, snore in their sleep, or "talk through their nose." Their throats are affected; their tonsils are often enlarged, and generally speaking the naso-pharyngeal cavity is covered with red granulations. Dr. Mayer says the patient's voice is singularly wanting in resonance, and the usual consonants cannot be pronounced,

exactly as in a common cold, patients thus affected being unable to pronounce the nasal sounds "m" or "n," will say "cobbod" instead of "common," "dose" or "lose" instead of "nose," "sogg" for "song" and being likewise unable to breathe through the nose, they are compelled to keep the mouth continually open.

Removal of the tonsils,* if very large, the frequent use of the Politzer bag, and astringent applications to

* Sir James Paget ("Medical Times and Gazette," Feb. 6th, 1858), makes the following remarks :—"There is a physiognomy by which the children and young people that have simple enlargement of the tonsils may usually be known at once. Together with a general appearance of feeble health they have a peculiar shape of the mouth and jaws. The jaws are narrow, so that the teeth are crowded and look disproportionately large. The aperture of the mouth is small, habitually slightly open ; the edges of the lips thick, but not pouting, the lower lip rather inverted ; the angles of the mouth a little raised ; the front of the mouth is almost uniformly convex ; the lower lip scarcely recedes towards the chin, but projects with a broad convexity, as if its middle part were slightly pushed forward by the tip of the tongue. The general expression is that of a gradual narrowing and a smooth uniform rounding of the lower part of the face, which make it look small and featureless.

"These peculiarities of shape appear due, partly to defective growth of the jaws, and partly to the habit which the patients have of advancing the lower jaw and tongue, in the position in which these parts are yet more evidently held during acute inflammation of the tonsils.

"For chronic enlargement of the tonsils, whether through simple over-growth or in consequence of chronic inflammation, the excision of the projecting portion seems by far the best treatment. So far as I have seen the cutting of tonsils is never followed by severe hæmorrhage or other serious inconvenience, provided they are not inflamed at the time of being cut. And I believe that if other means of reducing the size of enlarged tonsils be not quickly beneficial, the excision should be adopted both oftener and earlier than it commonly is."

the throat, will be found all that is necessary for the cure of these cases of deafness.

Accumulation of fluid in the tympanum is not so common an affection in adults as in children, yet it is frequently met with. The state of the weather has a marked influence on such cases, cold and damp especially affecting the hearing power, causing hyperæmia, with swellings of the tissues, and increased secretion, and thereby closing the Eustachian tubes.

Von Tröltsch gives an excellent description of the effect produced by long closure of the Eustachian tubes, and also the appearance of the *membrana tympani* in these cases, which he terms "moist catarrh." He says: "Should the closure of the tube continue long, it necessarily exerts an injurious influence on the deeper seated structures of the ear. As the air confined in the tympanum becomes gradually absorbed, atmospheric pressure acts upon the outer surface only of the membrane, which thus becomes unnaturally forced inwards, and with it also the chain of ossicula, and especially the foot of the stapes. By the abnormally increased pressure upon these structures, the *membrana tympani*, the ossicula, and the contents of the labyrinth, changes are necessarily produced in their structure and equilibrium, which may remain even if the normal communication between the ear and the pharynx is again restored. The *membrana tympani* appears abnormally concave, deeply sunk in, or, more correctly, forced in. In many cases the *membrana tympani*, though in no way altered in colour, give an impression as if it were thinned or atrophied, and then the long process of the incus, which may be almost in actual contact with the *membrana tympani*, behind and parallel to the handle of the

malleus, is very plainly visible through it. If a marginal thickening of the mucous coat of the membrana tympani has taken place in the earlier stages, the centre and periphery differ extremely from one another in colour and curvature. Whilst a wide marginal zone of denser tissue and whitish-grey appearance remains in its normal plane, the translucent, thin, greyish-red centre, bounded externally by a sharp line, projects, funnel-like, inwards.”*

Some patients with simple obstruction of the Eustachian tubes, when treated at once, recover even after one application of the bag. The following cases are good examples :—

35. Dr. P. came up from the country to see me for deafness in both ears, which he had had for three weeks. He could not hear my watch in contact with either ear. The bag caused a “tremendous explosion,” after which he could hear as well as ever. An astringent application for the throat was prescribed, and the deafness did not return. He had previously consulted Toynbee and Hinton for the same affection, with a similar result.

The symptoms and treatment are very much the same in all these cases, but I wish especially to direct attention to the rapid improvement derived from the use of the Politzer bag.

36. Mrs. G. had been deaf for two months in both ears, from “cold.” Said that “she thought that if she left it alone she would get rid of it, but finds she is getting rapidly worse.”

Feb. 2nd. *Hearing distance*: Not in contact with the right ear, $\frac{1}{2}$ inch with the left. 3rd. 2 inches right, 2 inches left. 4th. 8 inches right, 6 inches left. 7th. 24 inches right, 16 inches left. 9th. 3 feet right, 2 feet left. 12th. Quite well.

37. R. O., Esq., æt. 21, stated that two months ago he caught a

* Dr. von Tröltzsch, “Diseases of the Ear,” translated by J. Hinton, M.R.C.S., p. 51.

severe cold, and has been deaf ever since, and is getting worse. He was not in good health. The mucous membrane of his throat was very relaxed, and both Eustachian tubes were completely closed. Politzer's bag caused a loud report in both ears, after which his hearing was very much improved. An alum gargle, gr. x. to the ʒi , and a mixture of quinine and iron internally, were prescribed.

The good effected soon passed off, and he became as deaf as before. Politzer's bag was again used, and his hearing distance improved to 4 inches on the right and 12 inches on the left. I advised him to paint his throat every morning with tinct. ferri perchlor. ʒiss. to ʒi of water, and also to paint behind his ears with iodine liniment. He attended regularly, and derived benefit from every application of the bag. His throat and his general health improved considerably, all signs of fluid in the tympanum disappeared, and the last time I saw him he could hear several yards.

38. The next case is that of A. R., Esq. Deafness occurred a month after a severe cold. *Hearing distance*, 1 inch with right ear, but only in contact with the left. Both membranes were concave, and dark grey in colour. The pharynx and nasal passages were very congested, and he suffered from severe noises in both ears. After the use of the Politzer bag the hearing distance improved to 2 feet right, 1 foot left, but, as in the last case, two days afterwards the deafness returned. I prescribed an application of nitrate of silver, grs. ii to the ʒi , for the throat, iodine liniment to paint behind the ears, and a quinine and iron mixture as a tonic. The bag was regularly used twice a week, and in six weeks' time he could hear perfectly.

The following winter this patient caught cold, and became quite deaf again. He, however, took care to have it attended to at once, and in a very short time, by the same treatment as before, he recovered.

Colds in the head may be most effectually cured, according to Dr. Maclagan, by taking 20 grains of salycin every two hours; its full beneficial action can only be got by giving it in frequently repeated doses.*

* "Practitioner," November, 1877, p. 325.

39. B. R., æt. 55, came to see me at the hospital. She stated that five months before she had caught a severe cold from washing her head just before going to bed. Upon the following day she had great noises and deafness in both ears, both of which had been increasing. She could only hear my watch when in contact with the left ear, but not at all with the right. The same treatment was adopted as in other cases, from Feb. 3rd to March 27th, when she left the hospital well.

Having pointed out the great benefit derived from the use of Politzer's air-bag, and applications to the throat, in the milder forms of this disease, I now come to some of the *more severe* forms of chronic aural catarrh, where the use of the Eustachian catheter is necessary.

When Politzer's process fails to overcome an obstruction in the Eustachian tubes, whether this obstruction arise from chronic aural catarrh or other cause, the Eustachian catheter must be employed.

HOW TO PASS THE EUSTACHIAN CATHETER.

This is a very important operation, and yet the ability to perform it is a rare acquisition.

The patient should be placed facing the light, in a chair with a high back, against which the head can be firmly rested. The Eustachian catheter should never be passed on young children; it is unnecessary, very difficult, and, moreover, dangerous, for one can never by any means induce them to keep still. I very rarely use it for any patient under 15 years of age.

By far the easiest and best way of learning to use this instrument is, I believe, to pass it in the manner first suggested by Dr. Löwenberg. He recommended that after the instrument had reached the pharynx it should be turned inwards (instead of outwards) till it



EUSTACHIAN CATHETER.

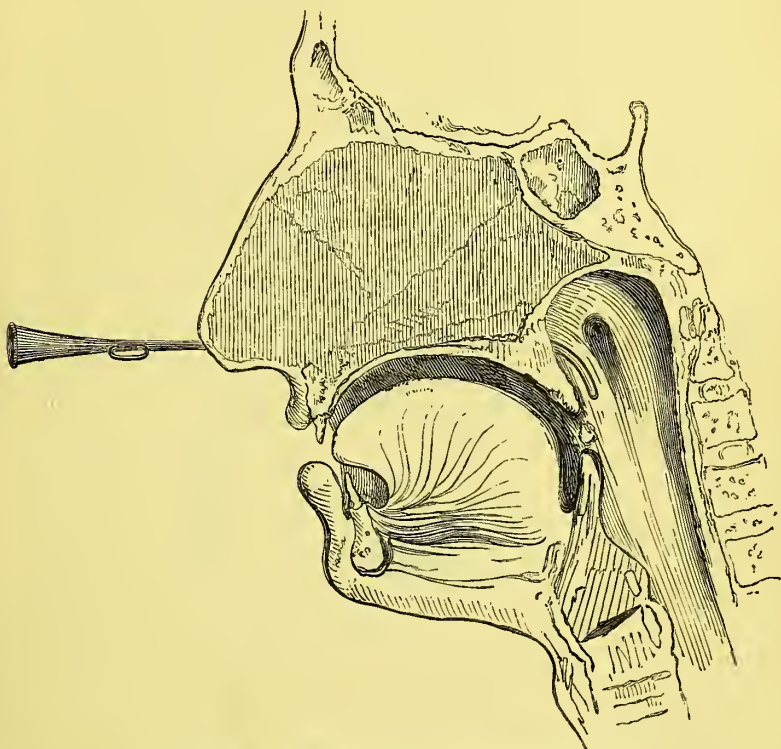
became hooked behind the vomer, and as it could then be withdrawn no further, it should be turned completely round at right angles, and the point of the catheter would thus be placed in the exact position sought for, viz., in the mouth of the Eustachian tube.

If the instrument, after reaching the pharynx, is withdrawn in the ordinary way, with the point turned outwards until the orifice of the Eustachian tube is found, great difficulty is frequently experienced. The instrument is not withdrawn far enough (or may be too far), or perhaps the point is inserted into the fossa situated behind the Eustachian tube.

It should be remembered also that the mucous membrane in nearly all catheter cases is in a delicate state, oftentimes highly sensitive, so that constantly moving the instrument backwards and forwards adds considerably to the unpleasant sensations of the patient, and may cause injurious effects.

Warm the catheter in hot water, depress the patient's lip, and introduce the instrument into the inferior meatus of the nose, pass it along the floor of the nares until it reaches the posterior wall of the pharynx, taking care to keep it at right angles with the plane of the face, and withdraw it until the

septum nasi is felt ; then rotate it with the point downwards to the opposite side, that is, turn it outwards and

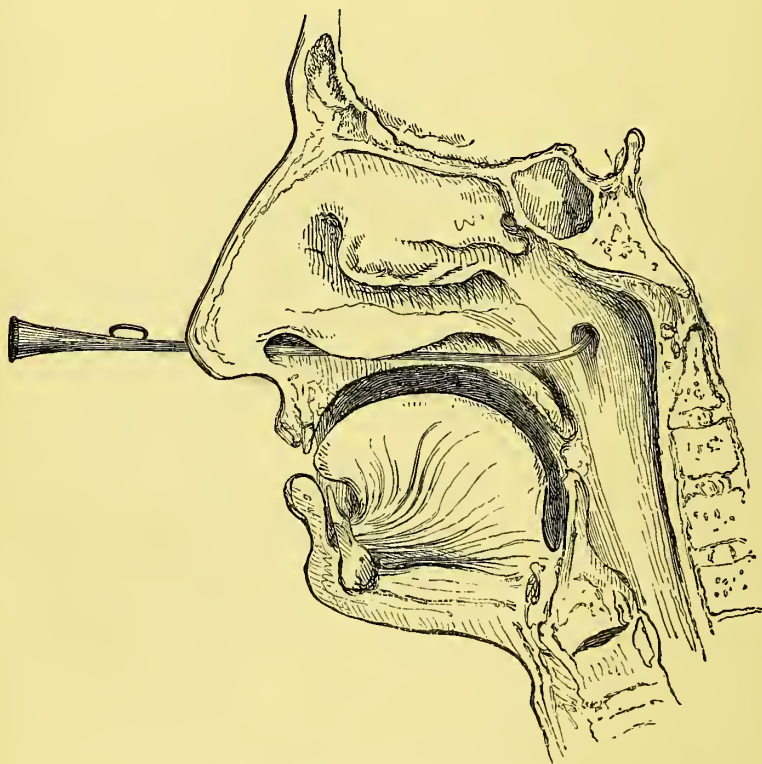


THE EUSTACHIAN CATHETER TURNED AND HOOKED ROUND THE VOMER.

a little upwards (this position will be shown by the ring at the other end of the catheter), and it will be found to have entered the mouth of the Eustachian tube.

I have passed the Eustachian catheter thousands of times in this manner with the greatest ease. I am con-

fidest it is by far the best plan. In the out-patient department of St. Mary's Hospital I have taught stu-



THE EUSTACHIAN CATHETER IN POSITION.

dents readily enough in this way; whereas by the ordinary mode they always experience difficulty in learning.

A catheter with a double curve, as first suggested by Dr. H. D. Noyes, is at times useful, for we can intro-

duce this instrument into the Eustachian tube from the opposite nostril.

The employment of the Eustachian catheter is occasionally attended with some disagreeable symptoms, such as epistaxis, nervous cough, pain, sneezing, irritation of the pharynx, &c., but such complications are generally soon relieved. If the catheter be passed skilfully, more serious results are almost impossible.

A syringe with a nozzle that fits into the larger end of the catheter is the instrument usually recommended for injection of fluids, &c., after the catheter has been passed. The surgeon standing in front of the patient, holds the catheter with his left hand and compresses the air-bag with his right. In this way every time the bag is compressed the catheter is liable to be forced out of its place, and so very considerable pain to tender mucous membrane may be caused by the movements of the point of the instrument. Again, if the left hand by any chance lets go the bag the catheter will be forced very unpleasantly upwards. Such accidents are impossible by the method I am about to describe.

The surgeon should stand on the right side of the patient and should have the air-bag (with a long india-rubber tube the end of which fits the catheter) attached by a loop to a button, as represented in the drawing; and after the catheter is passed to hold it firmly in position by the left finger and thumb against the nose. When we insert the end of the tube into the catheter, as the bag is hanging to our coat, neither the surgeon's hand nor the weight of the bag will be felt by the patient in the slightest degree, and the instrument will not be liable to be tilted upwards.

Further, we have as it were three hands, for the bag

is constantly in the position we wish at our right side, so that we can use our right hand to take up any fluid,



METHOD OF PASSING THE EUSTACHIAN CATHETER.

&c., we may require to inject without continually putting down the air-bag.

The late Dr. Peter Allen I believe first adopted this method; he stood, however, in front of the patient, and so did not hold the catheter firmly in position against the nose with the left hand as I have suggested. This I think a slight improvement on his plan.

Having described what I consider the best means of passing the Eustachian catheter, I will pass on to the consideration of the various forms of chronic aural catarrh where the use of this instrument is desirable. When we meet with patients whose hearing varies from

time to time, we may be almost certain that the mischief is to be found in the Eustachian tube and not in the tympanum. The congested state of the mucous membrane of the tubes being increased (especially in damp weather), extra secretion is poured out, and the mucous surfaces meet and thus exclude the air.

40. A. D., æt. 69, had been deaf four months. She was unable to hear my watch in contact with the right ear, but could hear it an inch from the left; the cause being catarrh caught by sitting at an open window. Both Eustachian tubes were closed. Politzer's process had no effect. I passed the catheter on both sides and repeated the operation twice a week for three weeks. She rapidly recovered, and at her last visit told me that she "could hear as well as ever."

41. J. F., a painter, æt. 40, had attended at St. Mary's for a great many years, formerly under Toynbee and Allen, and latterly under my care. His hearing varies from time to time, but suddenly, about every six months or so, he gets very deaf, and comes to the hospital to get relief from the catheter. The Politzer bag does not make the slightest impression on him, but directly the catheter is passed and the air-douche used, he says "he hears a bang," and his hearing comes back. He is ordered a strong astringent application for the throat (*argenti nitratis*, gr. x, to *ʒi*), and he gets almost well again. He is able to keep the tubes open by Valsalva's process with comparative ease for some months, until damp or foggy weather again brings on a total obstruction of the tubes.

In these cases there is always great concavity of the tympanic membranes, the centre part especially being sunken inwards, and in the upper portion the short process of the malleus shows out like a pin's head.

I could repeat numerous cases of the same kind where the greatest benefit has been derived from the air-douche regularly used through the catheter.

CHAPTER VIII.

CHRONIC NON-SUPPURATIVE INFLAMMATION OF THE MIDDLE EAR.

THIS form of aural catarrh may follow an acute attack, but more frequently it comes on without any previous warning. As a rule it begins with slight deafness and usually with noises in the ear, and the patient can generally fix its advent with accuracy, although in some instances the disease advances so insidiously that its origin and cause cannot be accounted for. The deafness and tinnitus aurium gradually increase, and a sense of fulness in the ears and throat is complained of. The state of the weather has a marked influence on the disease, cold and damp increase the deafness, and occasionally considerable pain is experienced from a sudden change in the atmosphere.

This form of aural catarrh has been divided into two forms—catarrhal and proliferous. In my last chapter I spoke of the use of the Politzer bag and the application of the air-douche by means of the Eustachian catheter, in the diseases of which I am about to speak more powerful remedies are necessary.

Some authors who have lately written on this subject deprecate the injection of fluids into the tympanum, and ascribe all the benefit derived to the stimulation of the Eustachian tube. No doubt an improved condition of the mucous lining of the tube will often very materi-

ally aid the patient; but the injection of warm fluids suitable to the case I am convinced not only renders the Eustachian tube pervious, but will often remove inspissation of mucus in the tympanum.

Again, it is contended by some that fluids injected in this way do not enter the tympanum at all. It is only necessary to prove this theory fallacious by a practical method, viz., to blow air and afterwards fluid through the Eustachian catheter and the patient will tell you without hesitation the totally different effect produced in the ear by the one and the other; the surgeon, moreover, can satisfy himself with some degree of certainty by the aid of the diagnostic tube.

Von Tröltsch remarks, "In moist swelling, and where increased secretion of the mucous membrane is present, vapours of chloride of ammonium are most useful, best evolved in a nascent state, whilst in a dry and thickened condition of parts, tepid or warm water vapours, alone or with iodine, introduced with a certain degree of pressure into the tympanum, most speedily promote reabsorption." Injections of astringent or slightly stimulating fluids (solutions of zinc, iodine, &c.) often produce the same effect, and are preferable in the case of a narrow Eustachian tube, and when too much irritation of the nasal mucous membrane would be produced by warm vapours.

42. A. G., æt. 64, came to the hospital March 31st, suffering from deafness, brought on from cold five years ago. Both tympanic membranes were concave and of dark yellow colour, and the Eustachian tubes were completely closed. The Politzer bag was used without any benefit. I then passed the catheter and heard moist sounds in the tympanum. A solution of sulphate of zinc (gr. v to ʒi) was injected into the tympanic cavities regularly twice a week, and after each application the hearing distance im-

proved. On April 14 the patient said she could hear the ticking of her clock, which she had not heard before for five years. On June 2nd she left the hospital with very fair hearing power.

According to Politzer, if there is little or no increase in the hearing distance, after repeated employment of the air-douche, we may infer that the deafness is caused by the sequelæ or the catarrhal affection, viz., thickening of the mucous membrane and of the coverings of the ossicula, with rigidity and diminished mobility of them, in which cases we can only expect improvement from the use of moderately stimulating injections, together with the use of the air-douche. In the instances which have come before me I have found great benefit derived from an often-repeated injection of a solution of iodide of potassium (gr. x to $\mathfrak{z}\text{i}$). I have never had in a single instance any ill effect produced, although I have used it constantly for several years. Two grains to $\mathfrak{z}\text{i}$ is the strength usually recommended.

43. Thus, in a lady (sent to consult me by Mr. Spencer Smith) who had been deaf for two years, her hearing improved very satisfactorily from this treatment. The tympanic membranes were of a very dark colour, and sunken inwards. Hearing distance when I first saw her was 12 inches right, 9 inches left. February 28th : 12 right, 15 left. March 4th : 15 both. 9th : 16 right, 19 left. 16th : 19 both. April 1st : 18 right, 24 left. 15th : 20 right, 24 left. The hearing distance varied after this from time to time ; the best was 26 right, 25 left.

In very deaf people, one inch gained makes a very considerable difference. In more recent cases the recovery from this mode of treatment is sometimes much more rapid, and where the benefit derived may be counted in feet instead of inches.

In some cases of a thickened condition of parts, the

injection of a weak solution of iodine is of great service.

44. This is the case with E. R., Esq.—When he first consulted me, he could only hear my watch one inch from the right ear, and was unable to hear anything with the left. He gradually improved by this means after everything else had failed, and when I last saw him he heard 6 inches right, 4 inches left, and I hope to get still better results by further treatment.

Weak solutions of sulphate of copper, liquor potassæ, nitrate of silver, hydrate of chloral, &c., are often useful. Of course it is of the utmost importance to select remedies suitable to the condition of the state of things observable when looking at the membrana tympani, and to the diagnosis arrived at from the various sounds heard through the diagnostic tube.

Steam inhalation, such as that of *ol. pini. sylvestris*, has a very beneficial effect in some cases; but it should be remembered as a rule that steaming is only of use in the dry forms of chronic non-suppurative catarrh.

What, then, is the appearance of the membrana tympani? As changes occur in its inner or mucous layer, and from various formations of impissated mucus within the cavity, alterations in colour will naturally take place; and it usually loses its transparency and appears dull. In many cases, where there is a considerable amount of deafness present, the tympanic membrane appears perfectly normal in colour, but on close inspection, there will be found to be a sinking inwards of the drum head, from adhesions within the tympanum, or, according to Weber-Liel, to contraction of the tensor tympani. To diagnose adhesion accurately, it is necessary to use Siegle's pneumatic speculum, for by this method the membrane, when it is adherent, will be

tightly fastened back, whilst the unattached portions will be drawn forwards.

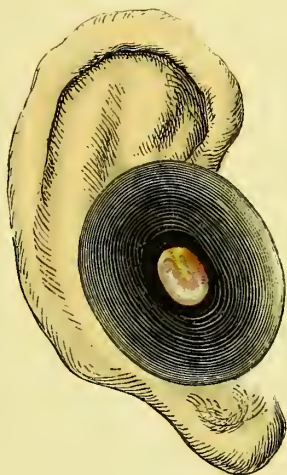
Dr. Woakes has introduced a new instrument, which he terms the pneumatic tractor, for drawing out the membrane from its collapsed position, and of detaching it from any adhesions it may have therein acquired. He says: "When, as occasionally happens, the adhesion is so firm that the membrane is torn in the act of separation when the instrument is used, the rupture takes the form of a slit-like rent, as though cut with a knife. In several instances improvement of hearing took place, and the noises and giddiness diminished.*

It is well to bear in mind that a concavity is never seen, without to some extent loss of hearing following. There is one remarkable appearance not unfrequently met with from calcareous deposits in the fibrous layer, which I have endeavoured to represent in the coloured plate. It is said to be the result of a suppurative process, which may or may not leave deafness behind it.

45. Another very successful case treated with the injection of the iodide of potassium through the catheter was a young lady, Miss M., aged 18, who had been deaf for 18 months, and was sent to consult me by Mr. Milson. Her hearing distance when she first came, November 2nd, was—Right ear, 8 inches, left ear, 16 inches. She improved as follows:—10th: 12 right, 16 left. 17th: 12 right, 20 left. 26th: 24 right, 20 left. Dec. 9th: 26 right, 22 left. Feb. 5th: 25 right, 30 left. 16th: 25 right, 35 left. March 4th: 30 right, 35 left. 17th: 36 right, 50 left; so that in the four months she was under my treatment, her hearing improved 28 inches with the right ear, and 34 inches with the left. She did not object in the least to the use of the catheter, and attended very regularly.

46. Another similar case is that of Miss B., a young lady of 17, sent to consult me by Dr. Jefferson, of Market Weighton. When

* See "Lancet," September 28th, 1878.



CALCAREOUS DEPOSIT IN MEMBRANA TYMPANI.



I first saw her the hearing distance was—Right ear, 12 inches, left, 4 inches. 2nd visit: 14 right, 7 left. 3rd visit: 16 right, 7 left. 4th visit: 20 right, 7 left. 5th visit: 20 right, 8 left. 6th visit: 25 right, 12 left.

It will be observed that in this case the hearing distance with the left ear remained stationary for a time, but subsequently improved rapidly.

47. Sergeant F., æt. 42, in the Army Hospital Corps, was sent to see me November 14th, from Netley, by Surgeon-Major Porter. He stated that he was stationed at Halifax in the winter of 1868; the cold was intense, and he suffered very much from it. His hearing gradually became impaired, and he was sent home, but has been more or less deaf ever since. When he came to the hospital he could hear the watch 1 inch right, 2 inches left. The Eustachian tubes were narrowed, and the tympanic membranes considerably thickened, and there was a condition of general hypertrophy of the mucous membrane. He was ordered to take three grains of iodide of potassium three times a day; and a warm solution of the same drug (ten grains to the ounce of water) was injected regularly every morning until December 8th, when he left for Netley, hearing fairly well again. Some days before he left he went to church and heard a sermon—the first time for seven years. He also heard perfectly well at the theatre, for his hearing distance had increased two feet on one side and three feet on the other. This case was a very favourable one for treatment; while it shows what good results are occasionally to be gained, when the membrana tympani is thickened, by repeated injections of fluids suitable to the case.*

In all cases I have found very great additional benefit from constitutional treatment, especially from the use of iodide of potassium and bichloride of mercury in strumous patients. In the majority of cases, it will also be found useful to apply nitrate of silver in solution (by means of a bent brush) to the faucial orifice of the Eustachian tube. Sometimes difficulty is experienced in injecting fluids into the tympanum. Politzer

* "Medical Times and Gazette," February 16th, 1878.

has therefore recently introduced the tympanic tube, an elastic instrument, which can be passed through the Eustachian catheter into the tympanum. Weber-Liel also recommends the same method, in chronic thickening of the mucous membrane, and also for sucking out fluid secretions. It is also said to be of use in chronic suppurative inflammation of the middle ear with perforation, to remove matter within the tympanic cavity, and for this purpose warm water alone is recommended.

Occasionally when the Eustachian catheter is withdrawn, it is found to be covered with thick mucopurulent matter. As a rule, gargles are of little use in thoroughly dislodging the tenacious mucus from the pharynx. The nasal douche no doubt is effective, but as its use is attended with a certain amount of risk, it is not to be recommended. Drawing up through the nostrils a weak tepid solution of salt, or of bicarbonate of soda, or permanganate of potash, will often be found of great service. But perhaps the best means of cleansing the naso-pharyngeal cavity is by the use of a syringe made for the purpose. Weber-Liel's is, I think, the best. His method he thus describes* :—"For some years I have used the syringe only for injecting the naso-pharyngeal space. My naso-pharyngeal syringe is made of glass, so that it can be seen that the fluid contained in it is pure, and free from admixture of dirt; the cylinder holds just so much fluid as the naso-pharyngeal space in the adult is capable of receiving. Both ends of the syringe are of hard india-rubber; its point is olive-shaped. The piston-rod is of metal, and ends in a ring, into which the thumb is introduced. While the

* "Medical Record," May 15th, 1878.

injection is being made, the head is held and fixed by the operator's other hand in as upright a position as possible. The olive-shaped point of the syringe is introduced firmly and in a straight direction into the nostril which has been found to be at least permeable by previous experiment (such as attempts at expiration in which the mouth and sometimes one, sometimes the other nostril, is closed, or exploration by the catheter); the fluid injection then meets with no impediment to its escape through the other nostril."

There are other cases, of course, of disease of long standing where we fail altogether to make any impression by means of the Eustachian catheter. In some of these patients, puncture of the membrana tympani is of service.

Mr. Hinton thus describes the operation* :—" Whatever instrument is used, it should be introduced into the meatus through the speculum with a good light falling on the membrane, which should be punctured in its inferior portion, either in front of or behind the termination of the handle of the malleus. A small amount of bleeding follows the incision, and if the case be a favourable one, an immediate improvement of hearing occurs." He recommends a syringe fitting hermetically into the external meatus for washing out the cavity of the tympanum. Dried mucus which has collected behind the membrana tympani can by this means be forced out into the Eustachian tubes or pharynx. It is extremely difficult to keep up a permanent opening; various methods are adopted. Politzer's eyelet, making the puncture with the galvano-cautery, by repeatedly passing bougies, the constant use of the air-bag, &c., &c. ;

* Holmes' "System of Surgery," Vol. 3, p. 166.

but it is very difficult to keep open an aperture made in the membrana tympani. The puncture generally closes up rapidly, so that unless (before the closure) some of the inspissated mucus can be got rid of, little or no good can have been effected.

This operation should only be attempted where other less hazardous means have been previously employed without avail; and in such cases where we are quite certain that the deafness can be relieved by the removal of the abnormal secretion which is interfering with the proper function of the membrana tympani.* Politzer says: "I perform paracentesis of the membrana tympani in those cases where, after the use of the other described methods of treatment for several days, no diminution of the exudation is observed, and where, even when exudation is not proved, the immediate improvement of hearing, which constantly follows the inflation of the tympanum, disappears in great part on the following day or the second day thereafter. The great advantage of this operation consequently consists in the shortening of the time the patient requires to be under treatment; but of 1,500 cases, in only four of them he says has consecutive inflammation of the membrane and mucous membrane of the tympanum supervened.† I have seen accidents from this operation, such as the following:—

A gentleman came to consult me a short time ago

* For further particulars respecting this operation, I would refer the reader to the discussion which took place at the Royal Medical and Chirurgical Society, after an interesting paper read by Dr. Laidlaw Purves. See "Lancet," March 30th, 1878.

† "Lehrbuch der Ohrenheilkunde für Practische Aerzte und Studierende," Stuttgart, 1878. "Glasgow Medical Journal," December, 1878.

with facial paralysis on one side, together with almost total deafness, which came on after this operation had been performed by a surgeon in the north of England. Another patient told me that he had had both membranes punctured by an aurist every week, for a period of two months. He said, "It always healed up the next day, and I am worse than I was before." A few deaths have taken place from inflammation of the brain resulting from this operation. In speaking of puncture of the membrane for disease of the tympanic cavity, it will be well to turn our attention for a moment to the position and size of the middle ear.

The middle ear or tympanum is situated in the petrous portion of the temporal bone, immediately above the jugular fossa, and is roofed in by a thin plate of bone, which separates it from the interior of the cranium. In front of it passes the internal carotid artery, which is separated from the middle ear by a very thin osseous lamina. At this aspect also the Eustachian tube and the canal of the tensor tympanic muscle enter. At the back of the cavity are placed the mastoid cells. The outer boundary is formed chiefly by the tympanic membrane; the inner by that part of the petrous bone which separates the cavity from the cochlea and vestibule—parts of the inner ear.

The distance between the tympanic membrane and the inner wall is not more than a quarter of an inch.

Tunnelled out of the substance of the inner wall is the circuitous canal by which the facial nerve is conducted, in its wandering course, from the bottom of the internal auditory meatus to the stylo-mastoid foramen. This bony canal, or aqueduct of Fallopius, is not entirely hidden in the substance of the wall, its course

being distinctly marked by a linear bulging on the tympanic side. Thin bone is heaped up all along the track of the nerve, just as in a meadow the upturned earth defines the course taken by the burrowing mole.

It will be remembered that the position of the aqueduct, and the delicacy of its covering on the tympanic side, expose the facial nerve to great danger during an accidental or intentional puncture of the membrane. This membrane consists of three layers, the external and internal of which are derived from the epidermal and mucous linings of the outer and middle ears respectively, whilst the intervening stratum is composed of a mixture of white and elastic fibres. Supposing that chronic inflammation of the middle ear has thickened this three-fold membrane, it will offer considerable resistance to the passage of a knife. Under the gentle pressure of the operator's hand, however, the membrane gives way suddenly, and, with a consequent jerk, the point of the instrument travels across the shallow cavity to impinge against, possibly to enter, the inner wall. Thus the facial nerve may be readily divided, but if it escape immediate division, effusion of blood into the tubular sheath of the arachnoid which surrounds it may cause subsequent impairment of its function.

The signs of injury to the facial nerve—immediate or delayed—will be unmistakeable. The muscles of the corresponding side of the face being paralysed, the orbicularis palpebrarum will be unable to close the eyelids; whilst the orbicularis oris and the buccinator being rendered useless, the food will lodge in the pouch of the cheek, or, mixed with a saliva, will trickle out of the mouth. (As the last-named muscle obtains additional

motor filaments from the third division of the fifth nerve, its paralysis on divisions of the facial will only be partial.) The mouth, which was previously evenly balanced between antagonistic muscular forces, is now drawn over to the *unaffected* side.

Impairment of the sense of taste on the affected side is a remarkable feature of injury to the facial nerve, and is, in all probability, to be accounted for by the injury to the chorda tympani (a branch of the facial) having checked the vermicular movements of the lingualis of that side, so that the sensitive papillæ are no longer subjected to that frictional stimulus which is necessary to render a sapid substance perceptible. This lingualis muscle also exerts a special influence in the protrusion of the tongue by causing a narrowing and consequent elongation of its own side of the organ. If the *right* chorda tympani is paralysed that side of the tongue will remain short, soft, and flabby, so that on the patient endeavouring to put out his tongue (the right side being paralysed whilst the left becomes stiff and elongated), the whole organ will be *pushed over to the right* (affected) *side*.

I am certain we can do an immense amount of good in long-standing cases of chronic aural catarrh by the Eustachian catheter and the injection of carefully selected fluids into the tympanum, together with constitutional treatment suitable to the case.

In conclusion, to use the words of my predecessor, "Whenever you see a patient dull of hearing, vacant in look, and only when he listens attentively capable of entering into conversation and distinguishing what is said (that is, only when he exercises the stapedius muscle by an effort of the will), it may confidently be

assumed that the accommodating power of the ear is defective or lost, in consequence of congestion and thickening of the lining membrane, plastic exudations, or adhesions in the cavity of the tympanum. The description of these symptoms and states of the middle ear, and of their liability to recurrence, will impress on the reader the necessity of preventing by timely treatment their becoming the source of permanent deafness."

Tenotomy of the tensor tympani muscle, an operation first introduced by Weber-Liel, of Berlin, to overcome the indrawing of the drum head and ossicula, and consequent intra-labyrinthine pressure, is strongly recommended as a means of relief for some cases, by some eminent authorities, such as Gruber, Frank, &c., who recommended that the operation should be performed through the anterior segment of the drum head ; whilst Voltolini and Orne Green suggest, that it should be performed through the posterior segment. It is said that the cases which derive most benefit from this operation are those in which relief is only for a short time afforded from the use of the air bag. Schwartze and von Tröltzsch have also recommended the operation in a modified form. The majority of aurists, however, in this country and in America are against its adoption.*

* For further particulars, see "A Treatise on the Ear," by C. H. Burnett, M.D., p. 420.

CHAPTER IX.

CHRONIC SUPPURATIVE INFLAMMATION AND
THE VARIOUS FORMS OF OTORRHŒA.

PURULENT discharge from the ear is one of the most common symptoms of aural disease. It may arise from a variety of causes. For instance, the exanthemata (especially scarlet fever) produce that worst of all forms of diseases of the ear, viz., acute otitis; which, however, may also take its origin from a blow on the side of the head, from colds arising from wet feet, sea-bathing, and so on. I have already given the symptoms and treatment of this malady in the chapter on acute and aural catarrh, so it will not be necessary to go over the ground again. This acute form, however, very frequently (from the pent-up matter bursting through the membrana tympani), leads to a chronic discharge, *i.e.*, otorrhœa. This chronic discharge, if not attended to, often further leads to very serious results, such as polypus of the ear, caries of the temporal bone, inflammation of the brain; or it may cause lobular pneumonia of pyæmic nature, with gangrene of the lung, from the lateral sinus or jugular vein becoming implicated, and some of the pus finding its way into the circulation. But a chronic discharge from the ear is by no means dependent on a previously acute form of the disease. In many cases—in strumous children, for instance—we never get any

history of an acute attack. The discharge comes on gradually, without any pain, and although oftentimes disgustingly offensive, is allowed not unfrequently to continue unchecked for months or years. No wonder, then, that it should occasionally be followed by some of the maladies I have just mentioned. It is therefore desirable that proper means should be adopted in time, in order to get the ear into a healthy condition, and so to stop the discharge. This is to be brought about—

1st. By constitutional treatment.

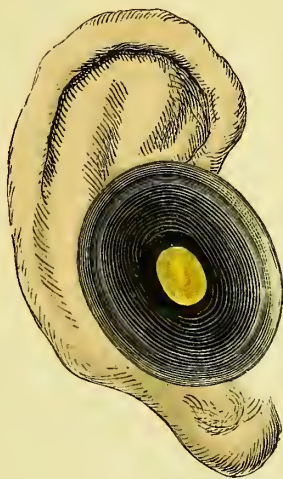
2ndly. By thorough cleanliness.

3rdly. By astringent applications.

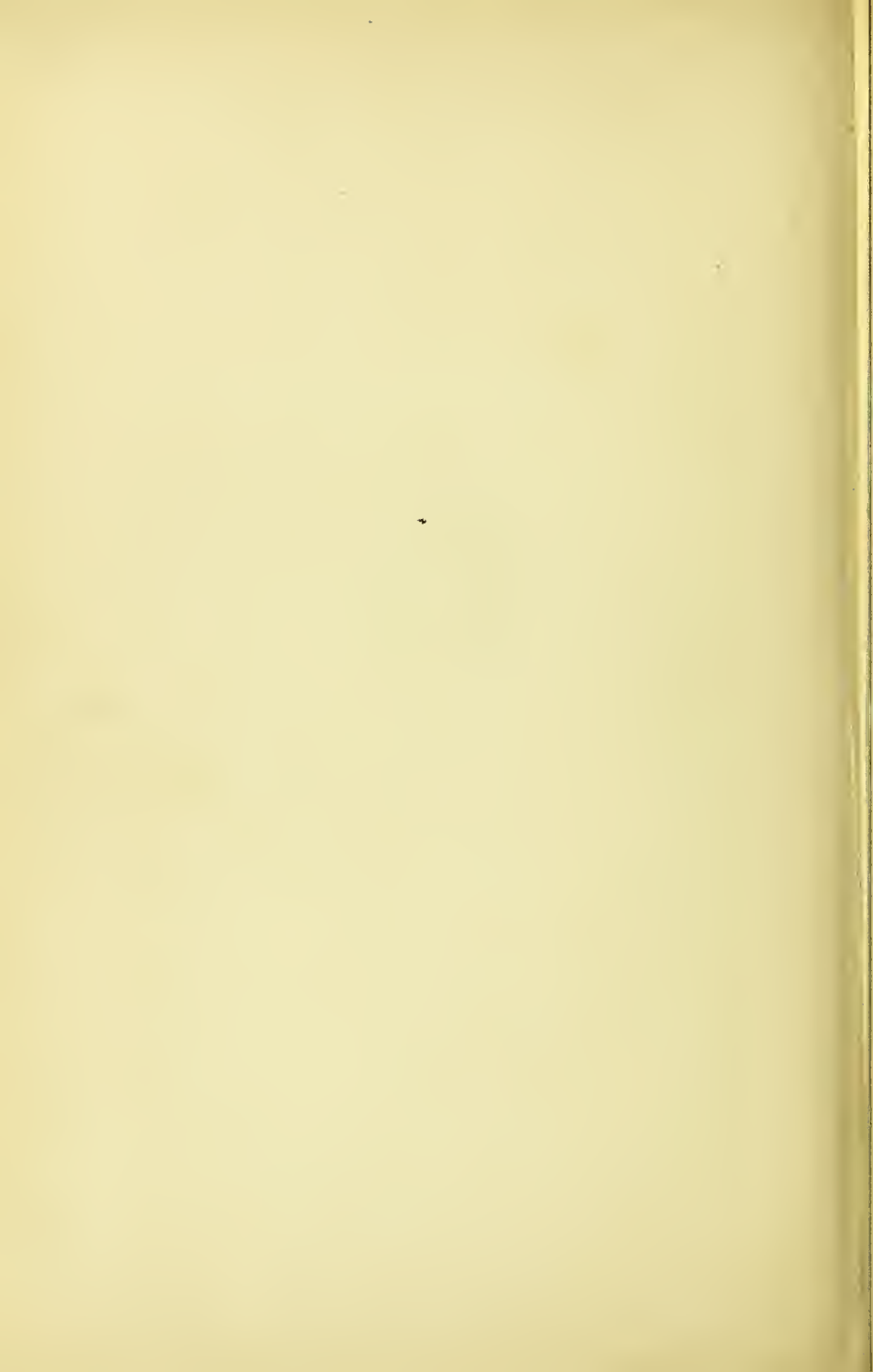
Constitutional treatment is of the utmost importance, and children suffering from this complaint, as a rule, require tonics. We can often cure a case of long standing otorrhoea, if, while we keep the ear thoroughly cleansed with a syringe and warm water, we simultaneously administer cod-liver oil and steel wine. The use of strong astringent lotions and thorough syringing will often fail to complete a cure unless we at the same time attend to the general health.

Astringent lotions prescribed for this disease should always be ordered to be used warm; the following is a case in point.

49. Master T., a little boy, aged five, was brought to me with discharge from both ears, which had been constantly going on for 18 months. His mother said nothing seemed to do him any good. I prescribed him cod-liver oil and steel wine, and a lotion of sulphate of zinc and carbolic acid, 5 grs. each to $\frac{3}{4}$ of water. The mother told me she had been using a very similar lotion for months without any effect. I asked her if she had applied it to the ears warm. She said no. I recommended her to do so, first syringing out the ears very gently with warm water and then



OTORRHEA.



pouring in some of the lotion, made warm, at least four or five times a day. The discharge gradually stopped, and in a very short time the child was quite well.

The following notes, which I give as concisely as possible, show the length of time otorrhœa is sometimes allowed to run on unchecked, and the comparative ease with which it is diminished or stopped.

50. Mr. C., æt. 25, came to me, giving the following history of his case : Severe attack of scarlet fever 18 years ago, followed by considerable deafness of the right ear, from which there had been a very offensive discharge going on constantly ever since. He could hear my watch only when within half an inch from the deaf ear ; the purulent matter was making its way through a large perforation in the membrana tympani, thereby setting up inflammatory action and causing very great pain. The pain entirely left him after the application of a few leeches, and I then prescribed weak lotions of carbolic acid and acetate of lead, to be used frequently, the strength being gradually and carefully increased. I also ordered a mixture containing iodide of potassium and nux vomica, under which treatment he gradually improved until he could hear my watch at the distance of eighteen inches ; and the discharge, of which he complained so bitterly on account of its offensiveness, both to himself and friends, entirely ceased.

These cases are constantly treated, and after a short trial are given up as incurable, in nine cases out of ten because the parts are not thoroughly cleansed. Dr. J. O. Tausley has lately observed :* “ Even after carefully syringing out an ear, if we examine, there will be seen pieces of tenacious mucus remaining in the various parts of the cavity ; and now if we instil the solution—argenti nitratis, for instance—there is an insoluble impervious coating of albuminates formed, which effectually covers the diseased parts, and prevents the benefit

* “ Nasal Catarrhs and their Treatment,” New York Medical Journal, August, 1878.

we had anticipated. Having thoroughly cleansed each ear with my cotton probe, using my forehead mirror and aural speculum, with the cotton moistened with the solution to be applied, I touched the diseased parts, and none other."

He recommends the same treatment in the nasal cavity for ozænic catarrh.

51. E. J., æt. 13, had scarlet fever 12 years ago, and had been deaf ever since, with a constant offensive discharge from both ears. Had a perforation in the right membrana tympani, but not in the left. She got rapidly better under the same treatment as adopted in Case 50, and the discharge, becoming gradually less offensive, at length stopped altogether. The perforated membrane did not much affect her hearing.

52. M. M. A., æt. 16, came to me with deafness and otorrhœa of a year's standing. The discharge had come on suddenly, and she had been in bad health ever since. Her deafness was getting rapidly worse. She could not hear the watch in contact. I ordered a quinine and iron mixture and astringent lotions, which were changed from time to time. In two months her hearing had almost returned, and the discharge had altogether ceased.

53. M. J. B., a little girl, æt. 10, was brought to me at the hospital in August, suffering from a purulent discharge from both ears. Her mother stated that for nine years she had had a "constant running" from her ears, and that for the last four months the external ears had been gradually "ulcerating away." The smell from the discharge was so offensive that none of her schoolmates could sit near her. Her appearance was most repulsive, for the central portion of both ears was sloughing away from the constant irritation of the acrid discharge. She was very deaf on both sides. This case is typical of a class which is very common in aural practice. The ears were dressed with calamine ointment, and the following treatment ordered:—Ears to be syringed six times a day with warm water, after which they were to be treated with a carbolic acid and sulphate of zinc lotion (five grains of each to the ounce); and a mixture of cod-liver oil and steel wine was to be taken three times a day. Her health improved rapidly under this treatment. In three weeks' time the discharge ceased entirely; shortly afterwards her hearing re-

turned ; and she left the hospital quite well. In some cases which give more trouble a weak solution of nitrate of silver (one grain to the ounce), applied by means of a probe covered with cotton-wool, to the external meatus, has often a very beneficial effect.*

These cases are very commonly met with, and unfortunately they often lead, as I have already stated, to very serious results. - We frequently find that the membrana tympani is perforated. The case very often begins with acute catarrh of the tympanum, the abscess bursts through the membrane, and leaves, if unchecked, the chronic discharge. The treatment for perforation of the membrana tympani I shall reserve for the next chapter.

* The strength of the caustic can be gradually increased, but I do not recommend the use of very strong applications of nitrate of silver in young children, as some aurists suggest. In adults, however, very strong solutions are useful, and often necessary.

CHAPTER X.

ON PERFORATION OF THE MEMBRANA
TYMPANI.

WHEN we remember how extremely difficult it is to keep open a puncture artificially made by the surgeon in the membrana tympani, it ceases to be very remarkable that recent cases of perforation, whether from disease or accident, can be treated so successfully as they undoubtedly may be if a little care be taken with them.

The treatment to be recommended for accidental injuries to the membrane due to the perforation of its structure by any sharp body (and this often is met with especially in hospital practice) has been already given at page 80.

A clean cut or slit, from the mere fact of the sides of the wound being in apposition, will heal up readily, as we often see after operations ; whereas a round aperture formed by oft-repeated discharge, involves either the use of an artificial membrane, or probably partial or complete deafness.

I will illustrate what I have just said respecting the former kind of injury—viz., a clean cut or slit in the membrana tympani—by relating a case that was lately brought to me by Dr. Randall.

54. A lady, dressing in a hurry for dinner, whilst brushing her hair, ran a hair pin (which somehow or other had become attached to the brush) into her right ear, rupturing the membrana

tympani. She experienced intense pain at the time of the accident, and she lost a considerable quantity of blood from the ear. When I saw her the next morning a large clean-looking slit could easily be distinguished in the membrane, which was intensely congested and very painful. She had almost lost her hearing in that ear, as she could only hear the watch in contact and closely pressed.

From the appearance of the wound, that of a clean-looking cut, I gave a favourable opinion as to the ultimate result. Four leeches were ordered in front of the tragus, and they immediately relieved the deep-seated and throbbing pain; and with the help of various and often changed weak astringent lotions the wound healed. In three weeks all signs of injury had disappeared, and her hearing was completely restored.

Very often, indeed, the wounds heal up very quickly, and little subsequent treatment is required. It is astonishing, considering the anatomical position of the parts and the close proximity of the brain, that more serious consequences do not oftener take place from these accidents.

55. G. B., æt. 54, a labourer, came to the hospital February 24th, 1874. Ten days previously he had fallen 8 feet from a ladder on to the side of his head. He had lost at least half a pint of blood from his left ear, was totally deaf on that side, and could not hear a watch in contact. He had been slightly deaf with the right ear since childhood. He said he constantly heard noises like water falling in his left ear. Air could be distinctly heard passing through the membrane when he was told to hold his nose and blow. The rupture in the drum head could be seen very plainly. He had a constant and most offensive discharge. In this case I thought that if I could get the mucous membrane of the tympanum into a healthy state and gradually stop the discharge, the large rent in the membrane would in all probability heal up; such eventually proved to be the case. I ordered the carbolic acid and sulphate of zinc lotion, and the ear to be very constantly washed out and kept thoroughly clean. On February 27th the discharge still continued, but was much less, and had altogether lost the disagreeable smell; the lotion was increased in strength, and he was ordered a mixture of iodide of potassium

and cinchona. On March 13th the discharge had quite stopped, the membrane had healed up, and he could hear the watch perfectly in the ordinary way.

56. J. H., æt. 28, came to the hospital March 27th, and was admitted into the accident ward. Says that a week previously he was running up stairs, when he suddenly fell, his head coming in contact with an iron rail; he was insensible for a few hours afterwards. He lost a considerable quantity of blood from his left ear. Complained of great noise on that side of the head. The membrana tympani was ruptured, and a thick offensive discharge came away. At times he was very giddy. He was treated in very much the same way as the last case. In a week's time the discharge had stopped; the membrane had healed up, and his hearing was restored as perfect as it was before the accident.

57. *Perforation of the Membrana Tympani, becoming permanent in consequence of delay in treatment.*

A lady had suffered from a constant discharge from the right ear, with deafness, for several months. She was sent to me by Dr. Pollock, whom she had consulted for her general health, before which time she had not thought the ear-symptoms of sufficient consequence to require attention. I found a large perforation of the membrana tympani. By treatment with astringent lotions, such as sulphate of copper (half a grain to the ounce), and keeping the tympanum well washed out in the ordinary way, this patient gradually lost the discharge, and her hearing distance improved from one inch to six, but the perforation remained. I believe that if she had been treated earlier, the opening might have been healed, and her hearing perfectly restored. The following case is confirmatory of this opinion.

58. Mr. D. was sent to consult me in January, 1877, by Mr. Maunder. Seven days before, after a violent fit of sneezing, he found himself deaf in the right ear. He could only hear the watch when in contact with the ear. I easily distinguished a large perforation in the membrana tympani. The surrounding mucous membrane was in an unhealthy condition. I therefore prescribed a lotion of sulphate of zinc and carbolic acid (five grains of each to one ounce of water), to be used four times a-day. In a few days the condition of the mucous membrane had improved, so a solution of nitrate of silver (half a drachm to one ounce) was carefully applied two or three times a week to the per-

foration by means of a probe covered with cotton-wool. In a few weeks the aperture had closed, all signs of injury had disappeared, and the hearing was quite restored. This patient was kind enough to call upon me three months afterwards, during which time he had been exposed to considerable changes of climate (travelling in Egypt), to let me know that the cure had been permanent.*

59. F. L., æt. 29, a painter, was admitted into the accident ward with a fracture of the temporal bone, of the right side, and a rupture of both tympanic membranes, from a fall on his head. He was brought into the hospital unconscious, with hæmorrhage from both ears.

Three days after admission he became sensible, but was totally deaf. He could not hear the sound even of a tuning-fork placed on the vertex. I saw him, with my colleague, the late Mr. Gascoyen. It was rather a complicated case, but we thought it probable that he had effusion of blood in the inner ear. He was blistered over the mastoid process, and took iodide of potassium for some considerable time. Both membranes healed up in a week's time, and he very gradually got back a fair amount of hearing. He remained in the hospital two months, and went out in good health.

In perforations of long standing, when there is also deafness present, I have seen very good results obtained from thoroughly washing out the tympanum with certain fluids. The membrana tympani is thickened, that is to say, the mucous membrane covering its inner surface and investing the ossicula is swollen from constant suppuration going on in the tympanum; or it may be that a collection of hardened mucus has glued together those structures so important to the proper perception of sound in the auditory apparatus. Should such be the case, then I maintain that if, by any means, we can lessen this thickening, by getting the mucous membrane into a healthy state, or by getting rid of hardened mucus and restoring the structure as nearly as

* "British Medical Journal," October 6th, 1877.

possible to its natural state, an immense advantage will often be gained; for in many cases the deafness is not dependent on the perforation, but on this thickening of the membrane. The following case is an example:—

60. I was called to see a lady in consultation with Dr. Cheadle. She had been deaf in the right ear for four years after measles. Could not hear my watch in contact. The membrana tympani was perforated and thickened—perforation about the size of a pin's head. I suggested that she should draw up through her nose a warm solution of bicarbonate of soda twice a day, and by this means thoroughly wash out the tympanum through the right Eustachian tube. A strong solution of nitrate of silver was also subsequently applied twice a week to the orifice in the membrane by means of a camel's hair brush, or by a probe and cotton-wool. The Politzer air-bag was also used occasionally, and a sulphate of zinc lotion was ordered to be poured into the ear daily, in the manner I have before suggested at page 120. The patient's hearing steadily improved, for when I first saw her she was not able to hear my watch in contact, but by this treatment she, inch by inch, gained two feet of auscultatory distance—a vast difference to a deaf person!

61. Another similar case was that of a gentleman, A. H. S., Esq., sent to consult me by Dr. Sieveking, 3rd April, 1876. Had been deaf seven years after scarlet fever, and when he came to see me he was getting rapidly worse. He had a small round perforation in both tympanic membranes. Could hear a watch ten inches from the right ear, two inches from the left. Had an offensive discharge occasionally from both ears.

By the same treatment adopted in the last case, he very shortly got well, and on April 29th could hear the watch at a yard's distance from either ear.

It is of the utmost importance in these cases of perforation to get the mucous membrane of the tympanum into a healthy condition; and this is best brought about by attacking it from within through the Eustachian tube in the way I have just shown, and externally through the perforation by means of warm astringent applica-

tions and the Valsalva method of inflation. We are able by these means not only to get the mucous membrane into a healthy condition, but also to wash away any abnormal discharges, or inspissated secretions that may be clogging up the fenestræ, and so preventing the entrance of sound into the labyrinth. It is not only the mucous membrane covering the fenestral openings, but also the proper functions of the ossicles, that are interfered with. Perforations of the membrana tympani, however, vary very much in the size, position, and shape, and in the effect they produce in the passage of sound. Two patients may have precisely the same kind of perforation arising from the same cause and looking as alike as possible, yet their hearing may be very different. The late Sir William Wilde was of opinion that "when once the tympanal membrane has become permanently open, the larger the aperture, the greater the amount of hearing, providing no further mischief has taken place, and that there is a slight ring or circle of the membrane still remaining."

In a case related by Sir A. Cooper, the membrana tympani was entirely destroyed on the left side, and partially so on the right, yet this patient, if his attention were excited, was capable, when in company, of hearing whatever was said in the usual tone of conversation.*

The amount of hearing power remaining after the membrane is perforated, is dependent in a great measure on the position of the aperture, and on the fact whether any of the ossiculæ have been injured or lost.

The incus, according to Allen, most frequently comes

* "The Cyclopædia of Anatomy and Physiology." Edited by R. T. Todd, M.D., F.R.S., vol. ii, p. 576.

away, as it is less firmly fixed than the other bones, and he says "it is important to note that this solution of continuity, especially in the articulation between the stapes and incus, may take place in the purulent inflammatory process, without necessarily any rupture of the membrana tympani: and it is in such instances as these that a most surprising improvement in hearing follows when Yearsley's artificial tympanum is applied to the membrane; the incus being thus pressed against the stapes, and the continuity of the chain restored."

We occasionally find more than one perforation in the membrana tympani, but the largest we meet with are, as a rule, the result of scarlet fever. Toynbee gives an excellent description of these injuries. He says:—*

"In cases of general ulceration of the mucous membrane of the tympanum, the incus is commonly discharged, and sometimes the malleus also; but even in these cases, if the attachments of the stapes to the circumference of the fenestra ovalis remain uninjured the power of hearing may be greatly improved; should the stapes, however, be removed, total and irremediable deafness ensues. In the management of cases of perforation, we can often improve the hearing in a very satisfactory degree by treating them in the manner I have stated, viz., getting the mucous membrane into a healthy condition, and removing abnormal secretions which may be causing obstruction to the passage of sound."

In other cases better results may be gained by the introduction of an artificial membrana tympani. It is impossible to tell beforehand, however, whether these instruments will be of any service. Some patients

* "Diseases of the Ear," page 166.

derive the greatest benefit from wearing them, while others do not seem to gain any advantage. In the "British Medical Journal," June 19th, 1875, I published a paper on this subject, which I now give.

"ON A NEW FORM OF ARTIFICIAL MEMBRANA
TYMPANI.

"In treating cases of perforation of the membrana tympani, it has always appeared remarkable that some patients should derive benefit from Yearsley's pellet of moistened cotton-wool; while others gain greater advantage from Toynbee's artificial membrane. It has, therefore, occurred to me that the instrument I am about to describe might prove advantageous; and such I have found to be the case. It is simply a combination of Toynbee's artificial membrane, viz., a thin disc of india-rubber mounted on a fine silver-wire stem, with Yearsley's cotton-wool. In my instrument, the wire is carried beyond the india-rubber for about a quarter of an inch, and terminates in a second disc, made of flannel. The space between the two is filled up with a small portion of Dr. von Brun's wound-dressing cotton-wool, which is absorbent, and so takes up and communicates to the flannel disc any medicated solution which it may be desirable to apply. To prevent overcharging the cotton-wool, a pipette should be used, as one or two drops are sufficient to moisten every fibre of the wool and flannel.*



"Its advantages are the following:—

"1. It does not irritate the membrane, and being very soft, is not likely to injure it.

* It is made by Messrs. Krohne and Sesemann of Duke Street.

"2. It is made of cotton-wool, which is absorbent; lotions can by its aid be constantly applied with much advantage.

"3. By thus keeping the part clean, the membrane gets into a healthy state, and the perforation heals.

"The hearing distance is improved.

"5. It is not liable to leave the india-rubber disc in the meatus.

"It is easily used; and does not require the forceps, as Yearsley's cotton-wool does.

"The following cases are interesting:—

62. "E. F., aged 26, a clerk, came to consult me at St. Mary's Hospital, having suffered from deafness for twenty years. Both membranes were perforated. On the right side there was a large perforation; he could not hear my watch in contact. On the left side there was a smaller perforation, and he heard the watch at the distance of an inch. On the right side Toynbee's membrane increased his hearing about seven inches; cotton-wool had no effect. In the left ear Yearsley's mode of applying cotton-wool answered best; the india-rubber disc having very little effect on this side. With my instrument he could in time hear nearly eighteen inches on each side. His hearing therefore was greatly improved, the membranes gradually getting into a healthy state. He said 'I can now hear sermons,' a benefit he had never previously been able to enjoy.

63. "H. J., aged 19, came to consult me at St. Mary's Hospital. She had been deaf for two years in both ears. The deafness came on after measles. She had a large perforation of the membrana tympani on the right side, with constant offensive discharge. She could not hear a watch in contact. After the new artificial membrana tympani was used, her hearing improved one foot, and by using (with its help) various lotions applied directly to the perforation, the discharge gradually ceased, and her hearing distance when wearing the instrument became quite one yard, against about four inches without it, the membrane looking healthy, and the perforation being decidedly smaller.

64. "W. D., had perforation of the left membrana tympani.

He could not hear a watch in contact. He had been deaf eight months; the deafness came on after 'brain-fever.' This boy's hearing improved four inches, and the discharge, which had previously been very great, ceased altogether.

65. "H. L., aged 17, had had deafness for five years in both ears after scarlet fever. There were large perforations in both membranes. With Toynbee's artificial membrane, her hearing greatly improved, say four to five inches. The application of the cotton-wool also afforded benefit; but, with the combination of the two, a still better result was obtained; for, when she wore it in her ears, she could hear ordinary conversation perfectly well; and the hearing distances were twelve and fifteen inches. The lotion she latterly used (which quite stopped the discharge) consisted of two grains of the nitrate of silver to the ounce of water.

66. "S. M., aged 26, had perforation of both membranes, much the same as the last case. It came on from scarlet fever. Her hearing was improved to a very great extent on both sides. She said that my instrument was much more comfortable than the other, and did not move about like the india-rubber one; she also heard double the distance with it. The discharge stopped.

"I have had several other cases of the same kind, both in hospital and private practice, in all of which the benefit has been the same.

"Dr. Peter Allen* was of opinion that 'in Yearsley's contrivance (when the natural membrane is perforated or lost) the benefit is derived from support given to the ossicula, by which they are enabled to exercise that due pressure at the fenestra ovalis, which keeps the membrane of the fenestra rotunda in a condition susceptible of vibration, and capable of transmitting them to the nerve-expansion of the labyrinth.' And Yearsley himself says his object is to support the remaining portion of the membrana tympani or the ossicula, and that care must be taken that the entire opening be not covered, otherwise the experiment will not succeed; it is also

* "On Aural Catarrh," p. 371.

indispensable to success, that the moisture of the wool should be preserved.”*

“Toynbee, on the other hand, says, ‘It seems to me doubtless that one of the functions of the membrana tympani is to confine the sonorous undulations to the tympanic cavity, in order that they may be concentrated on the membrana fenestræ rotundæ. Indeed, it is probable that the vibrations only partially pass through the chain of bones to the vestibule, and that the air in the tympanic cavity is one great medium of communication with the labyrinth. If the means of communication with the labyrinth be the air in the tympanic cavity, it is palpable that any aperture in the membrana tympani is likely to diminish the power of hearing, by permitting the vibrations to escape from that cavity into the meatus, and so preventing their concentration upon the membrana fenestræ rotundæ.’ †

“But, in the supplement of the last-cited work,‡ Hinton says, ‘Mr. Toynbee also modified the view he at first entertained.§ This he was partly led to do by intercourse with Dr. Julius Erhard, who, without any perforation, found his hearing much improved by the use of cotton-wool, and published his experience in a paper entitled, ‘Deafness Curable by Pressure.’

“Roosa says ‘That the artificial membrane is only of service in cases of partial or complete loss of the drum head.||’

“Von Tröltzsch quotes Politzer that the action upon which the benefit mainly depends is the pressure on

* “The Lancet,” July 1, 1848. † “Diseases of the Ear.” p. 160.

‡ “Diseases of the Ear,” p. 452.

§ “Diseases of the Ear,” by Dr. von Tröltzsch, translated by James Hinton, M.R.C.S.

|| “Treatise on Diseases of the Ear,” p. 380.

the remaining portion of the membrana tympani and the chain of ossicula; whether it be that by this mechanical influence a morbid relaxation in the connection of the ossicula is removed, or the fluid in the labyrinth is put under increased pressure. Such an india-rubber disc will act as a vibrating plate, and can transmit a considerable number of vibrations to one of the ossicula.

"This appears to me to be the best explanation. I use the cotton-wool for the necessary pressure on the remaining portion of the membrana tympani, and, at the same time, the india-rubber disc as a vibrating plate.

"The improvement I suggest I have found of great service in nearly all cases of perforation. The instrument should not be worn at first for more than an hour at a time, the cotton-wool should be often changed, and the lotions altered occasionally; and, lastly, it is very essential that only a very small quantity of fluid should be applied to the cotton-wool."

Dr. C. J. Blake, of Boston, recommends the use of small paper discs. He says:* "Covering the opening of the membrana tympani with a piece of sized paper wet with water, the sizing gives sufficient adhesion. The applications generally improve the hearing immediately, and the paper stimulates new growth from the edges of the perforation, and protects it until repair is effected. The new growth, being protected by the paper, is firm and tense, and serves to assist in the vibration of the membrana tympani as a whole, as a lax cicatrix would do. The paper is then removed by a natural process of repair and growth of the dermoid coat."

* "A Treatise on the Ear," by C. H. Burnett, M.D., p. 499.

CHAPTER XI.

THE RESULTS OF SUPPURATIVE INFLAMMATION.

As I have before pointed out, very serious results sometimes occur from allowing a chronic discharge from the ear to go on unchecked.

It is an extraordinary fact that people can still be found who maintain that a discharge from the ear is a salutary process ; nay, more, that it is almost necessary. An American writer justly observes, "As if the Creator would not have made the human race with such an one if it were necessary ;" and Wilde truly remarks, "Because it was observed that in the supervention of cerebral disease, discharges from the auditory canal have lessened, practitioners, mistaking the effect for the cause, have been led to believe that the sudden 'drying up produced a metastasis to the brain, a notion as crude as it is unsupported.' If such ideas as these are commonly believed, serious consequences must oftentimes take place. The out-patient department at any hospital will, I imagine, conclusively prove that such belief is common, at any rate with the lower orders. My experience is, that patient after patient will present themselves with running from the ear, who have all been told that 'it is bad to meddle with the ears.' Therefore they have allowed the discharge to continue until they become such a nuisance to themselves and their neighbours that the latter generally tire of it and begin to

discover, *not* that there is any damage to health or hearing, but that the smell is past endurance. It is my intention now to take the graver aspects that we may expect to arise in some of these patients, from the advance of disease out of the tympanic cavity, a cavity of which it has justly been observed, that 'there is no part of the human frame in such a small space borders upon so many important organs, and on anatomical grounds alone we ought to watch for, and dread, suppurative inflammation of the soft and hard parts.' "**

The anatomical relations of the tympanic cavity will not be here out of place.† It is said "to represent an irregularly shaped octagon. Its surface directed outwards, or the outer wall may be described as the wall of the membrana tympani, the inner as the labyrinth wall, the lower or floor as the wall of the jugular vein, the upper or roof as the wall of the dura mater, while the posterior wall presents irregularly bordered openings into the appendix of the tympanum, the mastoid process, and anteriorly it terminates in the channel, which, serving for the escape of fluid as well as ventilation, is directed somewhat downwards, the Eustachian tube."

Perforation of the membrane in suppuration of the middle ear is not altogether a misfortune to the patient. It is the only safe outlet excepting the Eustachian tube, which as a rule seems to be the very last means of exit through which the pent-up pus makes its way. The following is a good illustrative case:—

67. J. L., a clergyman's son, æt. 16, was sent up to consult me from Weymouth, May, 1878. He had been suffering from very

* Von Tröltsch, p. 66.

† Hinton's "Tröltsch," p. 31.

severe head symptoms, with intense pain, for three weeks, which was attributed to bathing in the sea* shortly after an attack of mumps.

When I first saw him he was still in great pain over the whole of the left side of the head, and was unable to hear a sound of any kind in the left ear, but no discharge had come away externally. His breath was most offensive, and he described a "feeling of fluid running down his throat," and he had a most disagreeable taste in his mouth. There was no bulging of the membrana tympani, which looked only slightly congested. I diagnosed this to be one of those rare cases in which pus forces its way through the Eustachian tube, and in which no perforation of the drum head occurs. Purgative medicines were ordered, and I leached him freely in front of the ear with considerable benefit, for the next morning the pain had almost gone. The tympanic cavity was subsequently regularly once a day washed out with a solution of iodide of potassium by means of the Eustachian catheter, and the patient did well, although he was deaf when he left for Weymouth.

I saw him again a month afterwards, and his hearing was completely restored.

If pus escape through caries of the upper wall of the tympanum, meningitis or abscess is necessarily the result, from the close contact of the brain with the roof of the tympanic cavity. If it force its way in the same manner through the lower portion of the drum, it must injure the jugular vein and lead to phlebitis, or, as Sir William Gull first pointed out, to pyæmic abscess of the lung of the same side, and sometimes to abscess of the liver of a like nature.

Again, if the inner wall be implicated, death will probably take place from hæmorrhage of the carotid artery, which here lies in close proximity. Facial paralysis is often caused by the same means. These

* There is a most interesting account in the "New York Medical Record," of May 4th, 1878, of "Diseases of the Ear from Bathing," kindly sent me by the author, Dr. Sexton.

accidents almost invariably follow the chronic form of disease. A discharge from an acute attack of aural catarrh will, as a rule, burst through the membrana tympani; or if a bulging of that structure should be observed, the knife should at once be carefully resorted to, to let out the pus.

DISEASE OF THE MASTOID CELLS.

In these cases, as I have already pointed out, pus is allowed to remain in the cavity of the tympanum; caries of the bony wall takes place, and the discharge passes into the mastoid cells.

68. K. S., æt. 19, servant, was sent to consult me at St. Mary's by Dr. Owen Roberts, suffering from an abscess over the mastoid process. States that for the last five years she had had a constant discharge of a very offensive character from her right ear, and that she had latterly experienced a dull heavy pain at the back of the ear with great tension of the part. As it was clearly a case of acute inflammation of the bone, a deep incision was made through the periosteum, which let out a quantity of thick pus. At the time of the operation she was in a most critical state of health, with high fever, a pulse of 120, &c., &c.; but subsequently after the evacuation of the pus she rapidly improved in health. It is an excellent plan in all these cases to apply the syringe daily to the external meatus, and gently syringe through the tympanum and mastoid cells until the water finds its way out through the opening over the mastoid process. The parts were thoroughly cleansed in this manner, and also by a carbolic acid and zinc lotion afterwards.

Her general health improved under a course of quinine and iron. Small pieces of the necrosed bone gradually came away, and on the 11th of April she left the hospital in perfect health, the wound having quite healed and her hearing being almost restored.

69. M. C., æt. 25, a housemaid, was admitted into the hospital, under the care of Dr. Broadbent, June 9th. Said that she began to look pale 12 months since, though she felt well up to

Christmas, when she began to feel weak. About a fortnight since, she was sick all day, whether she took food or not. The colour of the vomit was yellowish-green, about three pints during the 24 hours. Felt very weak, with swimming pains in the head; everything seemed to go round; she could not see clearly, and had a "running" from the left ear. Said "the beat of the heart ran up to the top of her head on that side." Her pulse was 72. Temp. 98·8°. Had a lisp and slight difficulty in commencing to speak. The apex beat could scarcely be perceived.

On the 12th she complained of great pain in her mastoid process, and could not hear at all with her left ear.

15th. Did not feel so well. Was sick; said she felt sick and giddy. Complained of pain an inch below and to the left of the apex of the ensiform cartilage. The chest was sore and painful on percussion; the breathing and inspiration short, rather sudden over front of left lung.

18th. There was still discharge from ear. Temperature, 99·2°.

19th. Dr. Broadbent asked me to see her. She complained of great pain over the whole of the left side of the head; she was unable to lie on that side. Said that when she put the left side of her head on the pillow, the "pains darted through her brain." She looked very flushed, and the discharge had nearly stopped from her ear. The skin over the left mastoid process looked red and swollen. She was unable to hear the slightest sound with the left ear. Said she "felt dizzy, and the patients in the ward looked quite small." I determined at once to make a deep incision on the mastoid process, to try and let out the pent-up pus. I accordingly carefully cut down to the bone. A large quantity of yellowish, creamy-looking, and very offensive matter escaped through the opening, and also through the external auditory meatus. I kept the wound open by means of a small piece of lint as long as the discharge lasted (about six days). The ear was syringed with warm water very frequently, and a lotion of sulphate of zinc and carbolic acid (gr. v of each to ʒi of water, warm), was ordered to be poured into the ear three times a day after it had been so syringed, the patient at the same time being directed to "hold her nose and blow." By this means; and also by drawing up weak lotions through the nose, the parts were kept constantly clean, and the discharge gradually ceased. By using the Politzer air bag occasionally, the Eustachian tube

was kept open. The wound closed, and on July 13 she did not feel the slightest pain in the mastoid process, the perforation in the membrana tympani had closed, and she heard very well again with the left ear.

Abscess in the brain (probably in the cerebellum) would no doubt have resulted if the opening had not been made. If the lateral sinus had been implicated (and the words she made use of, viz., "the beat of my heart runs up to the top of my head, on the left side," were, I think, significant), the case would probably have terminated in lobular pneumonia, with gangrene of the left lung.

A very similar case was sent up to me a short time ago from the Isle of Wight, when the wound remained open for several months, and small pieces of dead bone gradually came away, until at length the opening I had made healed.

70. L. T., a young woman, æt. 26, came to the hospital November 7, suffering from an abscess behind the left ear. She stated that ten days previously she caught a bad cold, followed by severe ear-ache. Five days after, an abscess burst in her left ear, from which time she had had a very offensive discharge from it. Two days before coming to me the discharge had lessened, and from that time she had suffered intense pain over the whole of the left side of the head, especially behind the ear. A deep incision was made over the mastoid, and the pus evacuated. She was sent up into the Manvers ward, and six leeches were ordered to be applied in front of the tragus, with the satisfactory result of entirely taking away all pain. A weak carbolic acid lotion was prescribed, to be frequently syringed into the ear. The discharge gradually ceased, the perforation in the membrana tympani closed, and she was discharged November 28, well.

This is one of the many cases showing the benefit that may be derived from—first, an early incision over the mastoid process; secondly, leeching freely; thirdly, constant washings with weak astringent applications.

Case of Mastoid Abscess and Separation of Sequestrum.

71. L. S., æt. 38, a German Pole, a hair-dresser, was admitted into the Grafton ward under my care June 29th, 1878. He stated that he had been suffering from a discharge from his left ear since September, 1877, and had also pain and swelling behind the ear. The origin of the mischief he ascribed to sitting in a draught whilst travelling by rail. On admission, as he was suffering from great pain, leeches were freely applied, and these were followed by hot linseed poultices, and considerable relief was afforded. The soft parts behind the ear were very much swollen and distended almost as large as the fist, and causing the pinna to stand out from the head. I immediately made a deep incision over the mastoid on to the bone and let out a considerable quantity of pus. The bone was found to be necrosed to a very considerable extent. There was no paralysis of any kind, but the deafness of the left side was almost complete. Much swelling and a copious discharge existed for a long time. Occasionally there was very severe pain and shivering, and the temperature fluctuating very much from day to day, and was as high as 102° F. on October 4th. Several openings were made from time to time, and they always afforded great relief, a drainage tube was left in for some days in the beginning of November, giving vent to a thick offensive and very copious discharge. Poultices were constantly applied, and the cavities frequently washed out with carbolic acid lotions.

On November 5th Mr. Brown, the house surgeon, removed a large piece of necrosed bone about half an inch in diameter, and subsequently other pieces of considerable size were taken away. After this the patient made a good recovery; he was treated with quinine and iodide of potassium three times a day. The wounds behind the ear closed, the discharge ceased, and when he left the hospital at the end of the year, although he had a large perforation in the membrana tympani, his hearing was not entirely lost. During his long stay in hospital, on two or three occasions he was in a most critical condition, and had it not been for the free vent constantly given for the discharge of pus a fatal termination no doubt would have taken place.

Toynbee long since pointed out that in children under three years of age, if the disease proceeded up-

wards from the mastoid cells, the dura mater and the cerebrum were the only parts that became implicated, whereas after that age the lateral sinus and cerebellum were most frequently affected.

There are three points, I think, absolutely necessary to observe in all these cases.

1. Early incision over the mastoid process through the periosteum down to the bone.
2. Constant cleanliness and antiseptic treatment.
3. Attention to general health.

72. Last summer I was called down to Kew by Dr. Cundell to see a gentleman who was in a most critical condition. He had had a discharge from the right ear for some time, but it had suddenly stopped, leaving him with intense pain over the whole side of the head, so much so, that he could not bear to be touched with the bed-clothes. His temperature was 103; pulse 120, with constant vomiting, diarrhœa, and shivering. I immediately ordered eight leeches round the ear and a dose of quinine every three hours, and the leeches to be repeated in twelve hours if there was still much pain. The first set of leeches diminished all the symptoms in a remarkable degree; and the second batch still further improved matters. Two days afterwards I received a telegram to ask me to come down at once, as the symptoms were getting serious again; eight leeches were repeated in the same way as before, with the satisfactory effect of taking away all signs of mischief from the mastoid process, and stopping effectually what might well be considered very grave and perhaps even pyæmic symptoms.

AURAL POLYPI.

The formation of aural polypi is one of the most common sequences of otorrhœa. These growths arise almost invariably from the walls of the tympanic cavity.

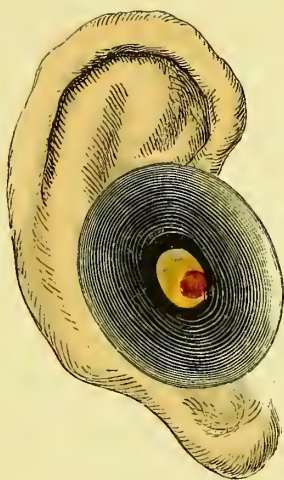
73. A girl, A. M., æt. 26, was brought to me at the hospital, with most extensive disease of the mastoid cells. She had had a polypus removed somewhere in the country, about a year pre-

viously; no after-treatment had been adopted, and the discharge was allowed to continue until the inflammation thus set up extended to the brain, and she nearly lost her life in consequence. A free incision over the mastoid process down to the bone considerably relieved her; and by careful treatment for six months, by astringent lotions, and by keeping the parts constantly clean, she entirely lost the discharge, and regained a very fair amount of hearing power. This case shows what mischief may result from neglecting proper treatment after the polypus has been removed.

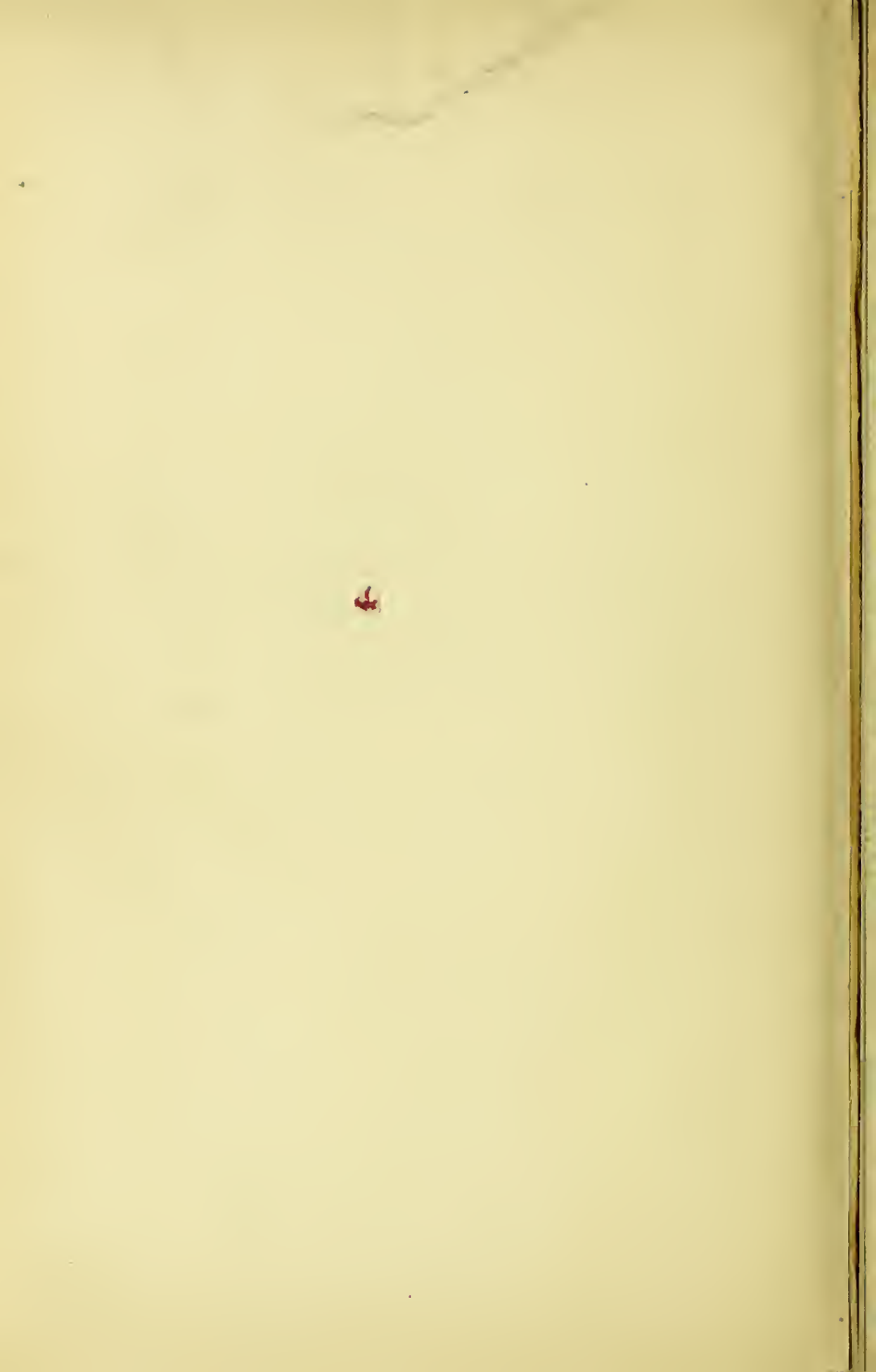
74. A lady was sent to consult me by Mr. Wilson, in June, 1874. The right membrana tympani was perforated, and a small red polypus could easily be distinguished making its way through that structure. She had suffered from an offensive discharge from that ear for eight weeks, with slight pain and tinnitus aurium. The ear was syringed frequently with warm water, and afterwards a warm solution of carbolic acid and sulphate of zinc (five grains of each to one ounce) was ordered to be poured into the ear, and allowed to remain for some time. The polypus was painted every morning with a solution of nitrate of silver, 30 grains to the ounce. After a very short time the discharge and the polypus disappeared, the membrane healed up, and the patient regained her hearing.

This case shows very well how smaller growths may be made to disappear by the constant application of caustics. Strong solution of sulphate of zinc answers very well in some of the softer kinds of polypus; but a combination of the two remedies, as used in this case, is perhaps the best treatment.

75. J. B., æt. 38, a labourer, came to the hospital, April, 1878, suffering from intense pain on the left side of the head. He stated that he had been almost completely deaf in both ears since he had a fall six years ago, and that for the last three months he had been under treatment for the intense pain in the head, which was attributed to neuralgia. At the end of April he came to St. Mary's, and was seen by one of the physicians for the out-patients, who at once discovering ear mischief, sent him to me. I found a large polypus blocking up the external meatus; I removed it, and



POLYPUS.



immediately a large quantity of thick fœtid pus was released and escaped from the ear.

He at once obtained relief; his hearing afterwards slightly improved; the pent-up pus had no doubt given rise to the severe head symptoms, and probably would have led to much more serious results if evacuation of the discharge had not taken place.

76. A. B., æt. 17, came up from Windsor to consult me at the hospital, March 15th, with a very large polypus in the left ear. Had been gradually getting deaf for six years, and had had during that time a constant discharge of an offensive character. I removed the growth in the usual way with Sir W. Wild's snare. The illustration gives the exact size of the polypus, the largest I have seen. She was very sick after the operation, but subsequently did remarkably well, the discharge entirely ceased, and in a month's time she went home with her hearing restored. The pedicle represented in the woodcut shows the size of the perforation in the membrana tympani through which the polypus passed.



77. S. B., æt. 59, came to the hospital in May, 1876.* She stated that 23 years ago she had a polypus removed from her right ear. She was placed under chloroform during the operation, and subsequently the external meatus was filled with cotton-wool. She was told that she would never hear again in that ear, as "the fangs of the tumour had come away." For a few years after the removal she experienced great relief, as the pain and discharge entirely ceased, but she could still hardly hear a sound on the right side. For the last two or three years a very offensive discharge had made its appearance, and latterly she had felt great pain over the whole of the right side of the head. During the last month the pain had been so great that she had been unable to sleep at night; and when she came to the hospital her face was very much swollen, and she could not bear her ear to be touched. Eight leeches were ordered in front of the tragus; they gave immediate relief. When she came again, what appeared to be a large polypus was seen in the right external auditory meatus.

* "British Medical Journal," December 16th, 1876.

Wilde's snare brought away a piece of the growth about the size of a pea. A hardened white substance was then removed, which proved to be cotton-wool which had been placed in the passage 23 years previously. The remaining portion of the polypus was then taken away; it had evidently forced its way along the roof, hanging over and completely covering the cotton-wool at the entrance of the meatus. A weak carbolic acid and sulphate of zinc lotion was ordered, together with a quinine and iron tonic. In a month's time the discharge ceased; and, although she had a large perforation in the membrana tympani, she could hear tolerably well.

78. G. G., a postman, æt. 56, came to the hospital in June. He had had a discharge from the right ear for 24 years. For the last 10 years he had been deaf on that side, and at times had felt very great pain. During the last year he said that about a teaspoonful of discharge had come from his ear daily, and that lately he had been so giddy, especially if he bent down his head to look at a letter, that he had been quite unfit for his work. A very large mucous polypus was removed. The same treatment was adopted as in the last case, with a like satisfactory result. Before leaving the hospital he said that he should have escaped a good many years of suffering if he had had the polypus removed earlier, but he had been constantly told "not to meddle with his ears."

These cases are of interest, as showing the great length of time people will suffer pain and submit to a loathsome discharge constantly pouring from the ears, without seeking relief.

The patient (Case 75) assured me that for three months he had been treated for violent headache and neuralgia, and in the hope of getting relief had spent all his savings, till at length he was compelled from want of funds to seek relief at an hospital. The polypus was somewhat deeply seated in the external meatus and so had escaped notice.

A great many more instances of the same kind could be adduced; but what I want especially to point

out is, that a successful termination to these cases is not to be expected unless a careful treatment is adopted after the removal of the polypus. If the discharge is allowed to go on unchecked after the operation, the disease will in all probability shortly return. Polypi are frequently removed, and no steps are taken to get rid of the accumulated secretion in the tympanic cavity, and, therefore, in a short time another polypus is likely to spring up. Thorough cleanliness is most essential. Hinton remarks :*—"Growths of this nature in the ear are extremely prone to recur, but the degree of obstinacy with which they resist treatment is very variable. In some rare cases they will come away spontaneously and leave a permanently healthy surface ; in others they will disappear before treatment, and show no tendency to recur ; in others their eradication is attended with the utmost difficulty. It has seemed to me that the accumulation of secretion behind the polypus or its root, is one of the most frequent sources of difficulty in their treatment, especially in cases where the membrana tympani is perforated. The viscid matter poured out by the spongy mucous membrane of the tympanum tends to cling about its various crevices and maintain a perpetual irritation, which sets every kind of caustic or healing application at defiance. Accordingly a chief object to be aimed at in the management of polypi is the perfect cleansing of the deep-seated parts of the organ. This is not to be effected by syringing merely, however vigorous and long-continued. Water does not remove the tenacious matter, nor, probably, does the stream reach the whole secreting surface." In all cases after the polypus is removed it is necessary to apply a

* "Supplement to Toynebee's Diseases of the Ear," p. 432.

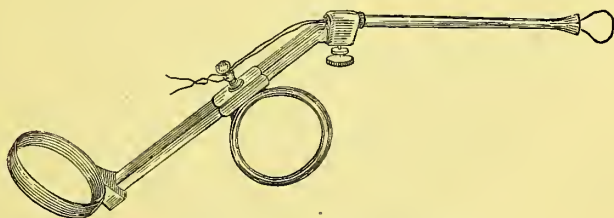


TOYNBEE'S LEVER RING
FORCEPS.

strong solution of nitrate of silver 480 grs. to $\mathfrak{z}\text{i}$, to the seat of the polypus by means of cotton-wool on a cotton holder. No pain will be caused if we take care to touch nothing but the root of the polypus. Mr. Dalby recommends chloroacetic acid to be used with the same caution, by means of a camel's hair pencil, every other day or so, until all signs of the growth have disappeared. Chromic acid is a still more powerful remedy, and may also be used advantageously. It is well after these strong applications have been used, especially if any pain is experienced, to syringe the ear with warm water. Very little pain, however, will be caused if the greatest care be taken only to touch the small spot from which the polypus springs; it is therefore best to guard the meatus with a speculum, and to use a strong light.

I have found, almost invariably, that aural polypi arise from the tympanum, and not from the walls of the external meatus; but they occasionally take their origin from the membrana tympani, and sometimes from the Eustachian tube. They are, as a rule, the result of long-standing otorrhœa, and the polypus

makes its way out through a perforation in the membrana tympani. They vary considerably in structure, size, &c. According to Stendener, the polypi which occur most frequently in the ear are mucous; the firm fibromata are less common; and the gelatinous myxomata the rarest. All kinds of methods have been proposed for their removal. Toynbee and Allen each invented an instrument—the former the lever ring forceps, and the latter a slender three-bladed pair of forceps. Dr. Purves has also introduced an excellent instrument for cutting



BLAKE'S MODIFICATION OF WILDE'S POLYPUS SNARE.

through the growth. I always use Wild's snare, as modified by Blake,* and prefer it to everything else that has been suggested.

The illustration shows the microscopical appearance of the most common kind of aural polypus. I am indebted to my colleague, Dr. Shepherd, for the following notes:—"On section the growth showed the usual fibro-cellular structure of these polypi—round, oval, and stellate cells imbedded in a delicate reticulum of fibres. In some places the latter were almost absent; in others,

* A description of Dr. Clarence J. Blake's snare, which is also adaptable to other uses, may be found in the "Archives of Ophthalmology and Otology," No. 2, vol. i, published in Carlsruhe and New York, 1869.

and apparently in the neighbourhood of a collection of blood-vessels, the stroma was more distinctly fibrillated.



The blood-vessels themselves, as shown in transverse and longitudinal section, were pretty numerous."

FACIAL PARALYSIS.

Facial paralysis does not unfrequently follow a chronic discharge from the ear. I cannot do better than repeat what Dr. Hughlings Jackson has so well said:—"Uncomplicated facial disease, with ear disease, is not a cerebral symptom; it is not an intracranial symptom; it is scarcely an ear symptom; it is rather a bone symptom. It is occasionally the precursor of facial intra-cranial mischief; but, as a matter of fact, not often, and when so, it is independent of it, the ear disease, by distinct processes,

happens to do two entirely different things at once, or in quick succession. It is erroneous to infer that because the process by which the palsy results is a gross one, recovery will not follow, complete recovery often does." My experience is the same. Quite lately my colleague, Mr. Edmund Owen, sent me such a patient, and I have seen many others afflicted in like manner that have done remarkably well. Von Tröltzsch observes, "The facial palsy does not even show much extension of the tympanic disease, but only slight extension in an unfortunate direction."*

Paralysis of other portions of the body must often necessarily result from injury to the brain, however brought about. Thus, complete hemiplegia is not unfrequently met with in patients suffering from cerebral abscess, &c.

If the inner wall of the tympanum be implicated, hæmorrhage from the carotid artery may take place. There are but very few cases of this kind recorded.

Lastly. Albumenuria is said to not unfrequently follow chronic suppuration of the middle ear.

* See pages 115 and 138.

CHAPTER XII.

THE RESULTS OF SUPPURATIVE INFLAMMATION (*continued*). CEREBRAL ABSCESS, &c.

If matter escape through caries of the upper wall of the tympanum, meningitis, or abscess is necessarily the result from the close contact of the brain with the tympanic cavity. I will illustrate this first by a case of meningitis.

It is one of suppurative meningitis, of a very localised nature, confined almost entirely to the under surface of the tentorium cerebelli, the membranes at the base of the brain being unimpaired.

79. M. A. C., æt. 19, servant, admitted into hospital December 4. Had had a discharge from the left ear since childhood; a fortnight before her entrance she had lost her senses, and would have fallen down, but for a fellow servant, who caught her. She had fainted, and had several rigors since. Had severe headache; talking, and especially looking at a bright light, gave her great pain. Her head throbbed; she saw double, and had pain over the second cervical vertebra, with intense pain below left ear, and confined bowels. The chest sounds were normal; temperature, 101·4. Double optic neuritis. Moved her limbs easily. The ear was syringed with a weak carbolic acid lotion, a blister applied behind it, and one grain of calomel and one-sixth of a grain of opium ordered every two hours.

On December 5th the patient was wandering and slightly delirious all night. At 8 a.m. she talked rationally. Her tongue was brown and coated with thick fur. At 8.30 a.m., the sister gave her some milk, which she drank, but almost immediately afterwards she died.

Post-mortem Examination.—A well-made, well-formed, and

well-nourished body. Slight discharge visible in left external auditory meatus. The left lateral sinus, at the point nearest the mastoid cells, where it curves round, was distended by ante-mortem clot. This did not extend throughout the sinus, and this was the highest point to which it reached, and below it stopped at the posterior lateral foramen. No clot in internal jugular vein. On removing the dura mater, the bone corresponding to this portion of the sinus was found discoloured, and somewhat softened. On opening the ear, pus and cheesy-looking material was found in the middle ear, extending backwards into the mastoid cells, where the bone was much softened. Pus was seen oozing over the surface of the base of the brain on raising it out of its bed. It was found to come from under the surface of the tentorium cerebelli, which was covered with pus. There was a layer of lymph (with extreme congestion of the surface of the brain immediately below it) on the upper surface of the lobes of the cerebellum, *i.e.*, that part in contact with the inflamed tentorium. The inflammation was very localised, and did not extend over the base where the membranes were normal. Brain tissue normal throughout, except a little softening about velum interpositum and septum lucidum, inflammation having apparently extended along the membranes from the adjacent spot of disease, and turned into the ventricle. The other organs were healthy.

Dr. Ramskill says that *inflammation of the dura mater* is apt to supervene in cases of chronic otorrhœa, an affection which frequently sets in after scarlatina, and sometimes after measles and variola. There is first merely a thick muco-purulent discharge from the ear, with some tenderness about the mastoid process, and this goes on for a long time, when suddenly the patient becomes dull and drowsy, complains of intense pain in the head; he then becomes delirious, and lastly passes into a state of coma. After death the petrous portion of the temporal bone is found carious and softened, and the dura mater overlying it is seen to be detached, inflamed, and generally bathed in pus.*

* Reynolds' "System of Medicine," vol. ii, p. 375.

In the case of an American gentleman, sent to consult me by Dr. Broadbent, who had all the symptoms of meningitis, and who suffered from intense pain in the head, I found that after I had cut down over the mastoid, and evacuated a considerable quantity of pus, that the greatest relief was afforded by applying spongio piline as hot as could be borne to the ear. Hot linseed meal poultices do not in my experience give nearly as much relief. A small piece of the spongio-piline should be cut to the exact size of the ear, and another larger piece about 6 inches square, covered over it; it should be changed frequently. This patient especially described the advantages of the spongio-piline. He said, "It draws out all the pain, whereas the poultices don't touch it." By the advice of Sir James Paget I gave him quinine and iodide of potassium, and he made a good recovery, and eight months afterwards I heard from America that he was quite well.

Dr. Gee* has pointed out that otitis interna is often undiscovered during life, and is a very frequent source of meningitis with a fatal result, and Dr. Greenfield has lately† noted the same fact.

ABSCESS OF THE BRAIN.

The following interesting case was admitted under the care of Dr. Handfield Jones, to whom I am indebted for the notes of it while in hospital. The remarks on the *post-mortem* examination, &c., are my own.‡

* "St. Bartholomew's Hospital Reports," vol. viii.

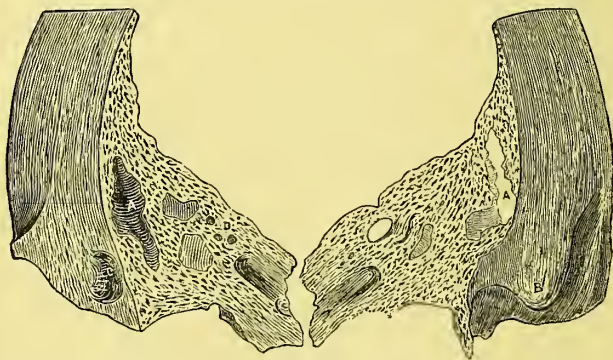
† "St. Thomas's Hospital Reports," 1878.

‡ "British Medical Journal," Dec. 19th, 1874.

80. C. T., æt. 20, groom, was admitted July 13th, 1874. His health had been generally good, except that he had been deaf in the left ear since he was six years old. Some discharge occurred occasionally. He was taken ill thirteen days ago with pain in the left side of the head from the mastoid region to the temple. He became unconscious and delirious on the morning of admission. The pain had been very severe, and discharge had occurred from the ear. When admitted, he was in a state of morose stupor, lying on the left side, refusing to move, and struggled violently when he was raised up to have his ear examined. The skin at the mastoid region was perforated by several small openings, and pus had escaped from them. A free incision was made in this part, which was distinctly tender; and a drachm of compound jalap powder was ordered, which acted well. He was ordered also four grains of iodide of potassium four times a day. On the 14th, he seemed better; he was more conscious, and showed his tongue a little when asked. The urine had a specific gravity of 1030, and contained a notable amount of albumen, and also of sugar, the albumen having been separated first. Pulse 87; temperature 102.2. On the 16th, he was more sensible, but very dull and listless in manner; and he had no pain. Pulse 76. There was a copious eruption of herpes round the mouth. At 2 p.m., he said he had pain in the head and felt no better. There was purulent discharge from the meatus and in the wound behind the ear; no dead bone was felt. On the 17th, he was very much better, was quiet at night, and fed himself during the day. He slept very well. Temperature 98.7; pulse 72. He answered questions very slowly. When pressed to say where he had pain, he put his hand to his forehead. He had, since the 16th, a lotion of 6 grains of sulphate of zinc, 2 grains of carbolic acid, and 15 minims of liquor morphiæ, in 1½ ounces of water, as an injection into the ear. A pint-and-a-half of urine was drawn off by the catheter on the 16th. The compound jalap powder was repeated. On the 20th, he was much better. He was much more conscious, heard a watch with the right ear; but not with the left even when touching the ear. Temperature 98.24; pulse 80. On the 23rd, he was doing fairly well. There was free purulent discharge from the wound behind the left ear. Temperature 99; pulse 86. The mastoid region was tender. He was more lively this morning, and much less deaf. The bowels were open. On the 27th, he felt, he said, very much better. There was a very

copious discharge oozing from small openings, very offensive. There were sinuses leading for four or five inches downwards and backwards, but no dead bone could be felt. He was ordered to have three times a day 4 grains of iodide of potassium with a drachm of tincture of cinchona in an ounce of decoction of cinchona. He took nourishment well. On the 29th, he uttered a single shriek every hour or so. After this, he did not improve. The pain in the head became more severe; he lapsed into a stupid condition, finally becoming comatose; and died on August 4th.

Post-mortem Examination.—Behind the left ear, the skin was dusky and infiltrated; and pus was escaping through an opening which had been made some days previously by the house-surgeon. A probe introduced showed the mastoid process to be denuded of periosteum, and roughened. On opening the skull, matter escaped which had been collecting in the form of a large abscess above the dura mater in the right parietal region. The pus, which was very offensive, somewhat resembled in



AA. Cavity formed by the abscess. On the right side of the drawing this cavity has, to a certain extent, penetrated the bone and entered the cranium. The section has been made exactly through the centre of the pyrogenic cavity. B. The mastoid process. C. Meatus auditorius externus. D. Semicircular canal, through the edges of which the section runs.

colour beef-tea. On removing the dura mater, which was red and thickened, the right hemisphere exhibited evident signs of compression from the pent-up pus. The dura mater had been

extensively separated from the skull from the left mastoid region to the seat of the great collection. This condition had, in all probability, resulted from the patient lying on the non-affected side of the head for a few days before death, the pus thus gravitating as he lay. On removing the encephalon, the left lobe of the cerebellum was found to be completely disorganised, and in direct communication with the primary abscess, situated in the cells of the left mastoid process. The dura mater itself was diffuent in that region. On making a section of the temporal bone, the mastoid process showed itself to be the birthplace of an extensive collection of pus, which had made its way through the thin wall of the groove of the lateral sinus, without opening into the venous channel itself. The thoracic and abdominal viscera were healthy.

REMARKS.—About a third of the cases of cerebral abscess arise from chronic suppurative processes in the middle ear.* Although the lateral sinus itself remained uninjured, this case points out clearly how easily inflammation extends to that sinus and to the jugular vein, accounting for the numerous cases that die from lobular pneumonia with gangrene of the lung, in consequence of chronic disease of the ear of the same side (Sir W. Gull, *Cases of Phlebitis with Pneumonia and Pleurisy, from Chronic Disease of the Ear.*† Also, as Toynbee first pointed out, “affections of the external meatus and mastoid cells produce disease in the lateral sinus and cerebellum;” and, lastly, to use the words of the same author, “the insidious progress of cases in which matter in the cavities of the ear injures the petrous bone and the brain, cannot be too often or too forcibly impressed upon the mind of the profession.”‡

This is only one of many instances of injury to the brain, which one meets with in practice. I could repeat

* Reynolds' "System of Medicine," vol. ii, p. 544.

† "Association Medical Journal," April 13th, 1855.

‡ "Medical Times and Gazette," March 16th, 1861.

many cases, for we have had several in St. Mary's during the last few years, consequent upon neglected ear disease.

PYÆMIA.—If pus finds its way through the lower portion of the drum, it may injure the jugular vein, and lead to phlebitis and pyæmic abscess of the lung, liver, &c. A remarkable case of this kind was lately in one of the isolation wards of St. Mary's Hospital, under the care of Dr. Handfield Jones, having been admitted on October 5, 1876, suffering from pyæmia, the result of long standing disease of the ears.

81. S. L., æt. 17, baker, stated that twelve years ago he fell off some pipes on to his head, and that blood came from his nose and right ear, followed by discharge and deafness on that side. Eight years ago he fell again on his head from a height of thirty feet, was picked up insensible, and became deaf in both ears, followed by offensive discharge from them, which has continued ever since. Six years ago he had another fall, when he had a compound fracture of the right arm. There was perforation of both tympanic membranes.

He stated that he had a bad attack of rheumatic fever three years ago. Three weeks before he came into the hospital, he suffered from frequent rigors, with high temperature, varying from time to time; also profuse sweating, with all the symptoms of pyæmia. A short time after admission a large abscess formed in his neck. For weeks he lay between life and death, but on December 9, he was able to walk about.

I think his recovery was in a great measure due to the fact that Dr. Jones ordered the windows of the ward to be kept always open, thus keeping up a constant supply of fresh air.

He left the hospital on the 18th of December, when Dr. Handfield Jones kindly sent him on to see me. When I first saw him, his hearing distance was one inch on both sides; but by blowing out the thick pus, which had collected in the tympanum, through the perforations by Politzer's process, and by constant washings with warm astringent lotions, his ears rapidly improved in every way, and he could hear my watch about eighteen inches off with each ear.

This is altogether a remarkable case. The complete recovery from pyæmia, after so many months of suffering, teaches us the truth of the old adage, that "while there is life there is hope," and it also encourages us to persevere, however desperate the condition of a patient may seem to be.

A few words now as to—1. How chronic discharge from the ear may lead to abscess of the lung. 2. How it may cause abscess of the liver.

Disease of the petrous bone may produce abscesses in both organs. These may occur in two ways; either by embolism of a small artery in the organ affected, or by what is known as metastasis. Should the abscess occur in the lung as the result of embolism, it is usually brought about as follows:—A thrombus occurs, say in the lateral sinus adjoining the diseased bone, the clot degenerates in the centre, and becomes changed into a yellow semi-fluid material, which is, indeed, pus, though some decline to call it so; a small vein entering the sinus just beyond the termination of the thrombus, washes away in its current small portions of it or its degenerate contents, carries them to the right heart, and so through the pulmonary artery to some of its small branches, when it becomes arrested and obstructs the onward flow of blood through the vessel; over-distension of and exudation from the branches of the plugged vessel next occur, owing to their anastomosis with their neighbours, and the infarction, taking its character from the embolism of pus which caused it, rapidly undergoes purulent infiltration, and forms an abscess. Around this abscess, thrombus of the veins of the lung may occur, as in the lateral sinus. Fragments of these may again be washed off, and pass to the left side of the

heart; whence they are distributed by the systemic circulation, and may produce similar infarction and abscesses wherever they may lodge, whether in the liver, spleen, kidneys, muscles, &c., &c.

Again, it appears that occasionally small purulent flocculi may be washed from the thrombus in the lateral sinus, and pass through the pulmonary capillaries without plugging them, though they may afterwards effect a lodgment in the liver or elsewhere, and thus produce abscesses in the viscera without an intermediate abscess in the lung. For our knowledge of this process we are indebted to the investigations of Virchow and Otto Weber. So far, the mode of origin of pyæmic abscesses has been made clear; it is not so, however, with those so-called metastatic abscesses. In their case, disease produces abscesses in organs with which these have no apparent anatomical connection, and for which it is not easy to assign a cause. They can, however, be sometimes accounted for by slowing of the circulation in some parts, producing passive congestions, and so predisposing the part to an inflammation, which may be lit up by the irritating poison in the blood. Of such a character are the abscesses met with at the base of the lungs, which cannot be classed as the results of infarction of the arterioles by portions of a thrombus. But why the base of one lung especially should be affected—namely, that on the same side as the disease in the skull—we are at present, I think, unable to say. Various nervous symptoms frequently occur as the result of otorrhœa in cases in whom no gross lesions can be discovered in the brain. Among these may be classed epilepsy and auditory vertigo, or Ménière's disease.

EPILEPSY.—Epilepsy occasionally follows chronic sup-

puration of the ears. It may be divided into two forms—first, that of ordinary epilepsy, as mentioned above, in which no gross lesion can be found; secondly, cases of epileptiform convulsions, limited to one muscle or group of muscles, often without loss of consciousness, and known as Jackson's epilepsy, occurring as a symptom of abscess of the surface of the brain connected with the membranes. In these latter cases, thanks to the experimental researches of Hitzig and Dr. Ferrier, to the no less valuable pathological observations of Dr. Hughlings Jackson and Professor Charcot, and the anatomical investigations of Dr. Broadbent and others, we may so accurately localise the disease that one may even venture to trephine the skull, to let out pus connected with the dura mater—an operation which was, indeed, successfully performed by Mr. James Lane by the advice of the latter accomplished physician, at St. Mary's Hospital, a few weeks ago.

As a type of very obscure nervous symptoms, I may relate the following case:—

82. A girl was brought into the hospital in an unconscious state, who had suffered from a chronic discharge from the ear for some years. Before she was admitted, the discharge suddenly stopped. She lay in bed totally unconscious; but I could not discover any signs of disease of the ear. However, as she had had a discharge occasionally, I suggested that eight leeches should be placed round the ear. This had a somewhat beneficial result. She regained consciousness, and was able to talk; but she as suddenly relapsed into her former condition, and shortly afterwards died. At the post-mortem examination, which was most carefully made by Dr. Mahomed, not the slightest trace of disease of any kind could be found—the internal ear, brain, spinal cord, and all the other organs were perfectly healthy.

Lastly, before I leave the subject, I would just mention that insanity may occasionally result from ear

disease, such as abscess of the mastoid process. A very good case in point has been recently described by Dr. W. Rhys Williams and Dr. Savage, of Bethlem Hospital, in which all symptoms of acute mania disappeared after the evacuation of pus from the mastoid cells.

These are some of the many diseases following otorrhœa. Some of the latter cases I have mentioned more properly belong to the next chapter. I have included them here, however, as they will be seen to have been in nearly every case a direct result of suppurative inflammation of the ear.

CHAPTER XIII.

DISEASES OF THE INTERNAL EAR.

PRIMARY disease of the internal ear is fortunately rare; but secondary forms caused from injuries to the head giving rise to effusion of blood, &c., into the labyrinth, are among the most frequent sources of so-called nervous deafness. Injuries to the internal ear may be traumatic, or they may be brought on by fevers, meningitis, syphilis, mumps, rheumatoid arthritis, &c.; and in locomotor ataxy, impairment of hearing is an occasional symptom.

Even very slight blows, or falls may so interfere with the proper functions of the brain or labyrinth as to cause incurable deafness; either from laceration of the parts concerned, or from effusion of blood or serum inside the ear.

In many of these cases, upon examination with the speculum, no trace whatever of disease or injury can be discovered; the *membrana tympani*, in fact, looking perfectly healthy.

It may be asked, "How then do we arrive at a correct diagnosis. How do we distinguish between loss of hearing due to mischief in the labyrinth, from deafness caused by disease of the middle or external portions of the auditory apparatus?" The vibrating tuning-fork is our best guide, but it will be seen hereafter that it is not a certain one.

In treating ear diseases, it is important to bear in mind that the organ of hearing is made up of two fundamentally different parts. First, a sound-conducting; and, secondly, a sound-perceiving portion. The first comprises those delicate structures whose function it is to carry sonorous vibrations to the second, the sound-perceiving portion, which latter consists of the complex structure of the auditory nerve, &c.

If the vibrating tuning-fork be placed on the head of a deaf person, he will probably state that he hears the sound most in the deaf or deafer ear, which fact at once informs the surgeon that there is some disease in the conveying portion of the auditory apparatus, that is, in the external or middle ear, producing an obstruction to the passage of sound, either in or out of the ear.

Upon the other hand, if the patient hears the tuning-fork in the better ear, there exists probably some lesion of the labyrinth or auditory nerve. In other words, the loss of hearing arises from disease of the sound-perceiving portion of the ear.

In this experiment the vibrations of the tuning-fork are carried by the bones of the head to the inner ear, and the same obstruction which makes the patient deaf to ordinary sounds, intensifies that of the tuning-fork by retaining its vibration within the ear; whereas on the healthy side these vibrations pass out through the external meatus without opposition, and are consequently only heard to a very slight extent. This may be realised by any one not deaf, by placing a vibrating tuning-fork upon his forehead, and then closing one ear with his finger, when the sound will be much greater upon the side which he has thus temporarily obstructed. Much care, however, is necessary in order to obtain a

correct statement from a patient as to the side upon which he hears the tuning-fork best.*

A deaf person being fully impressed with the idea that he ought to hear more plainly on his *sound* side, will generally at first answer in accordance with this pre-conceived notion as to what he *ought* to hear, rather than state what he actually *does* hear. A few trials will, however, elucidate the truth, and as nerve deafness is comparatively rare, it will be well to accept evidence of its presence with great caution.

It is commonly supposed that nervous deafness is more frequently met with in persons of nervous temperament, than in others; but such in my experience is not the case.

In illustration of true nervous deafness, I will give the records of a few cases of disease of the nervous apparatus, added to affections of the middle ear.

83. G. C., æt. 5, was brought to me at the hospital September 15th, 1876, suffering from complete deafness in both ears. His mother stated that eighteen months before he fell down stairs, alighting on his head, was picked up in an insensible condition, and remained so for nearly a week. He had been totally deaf ever since the accident.

Fortunately, he was still able to talk, having learned to speak tolerably well before the injury, otherwise he would have remained dumb, as well as deaf. He could not hear the tuning-fork pressed to his forehead, or even a pistol fired off close to his ear. His mother had an idea he could hear to some extent, as he appeared to recognise knocking sounds. The faculty, however, of distinguishing the concussion thus produced in all cases of total deafness, is due to the patients *feeling* the vibration without *hearing* them.

Stamping on the ground, or clapping the hands, will often attract the attention of totally deaf persons in the same way.

* "Medical Press and Circular," December 19th, 1877. .

The hearing having been lost, the other senses are brought into greater use, and become more highly developed.

The precise nature of the injury received in these cases cannot always be determined; but in a great many instances effusion of serum or hæmorrhage into the semi-circular canals or cochlea may give rise to this form of deafness; or it may take place from laceration of the tissues of the membranous labyrinth.

Absolute deafness is the principal symptom of disease of the auditory nerve, and giddiness, tinnitus aurium, paroxysms of vertigo, faintness, and vomiting, may all be associated with the graver forms of nervous deafness.

According to Hughlings Jackson, the paroxysm always depends upon affections of the auditory expansion in the labyrinth.*

From *post-mortem* examinations, Toynbee found "atrophy of the auditory nerve thirteen times, in persons from sixty to ninety years of age. In others he found imperfect structure, and various diseases of both membranous and osseous semicircular canals. In some, black pigment deposited in the cochlea, also blood in the vestibule; in another, blood in the cochlea; in another, there were dark specks on the lamina spiralis in both ears, and this last individual had fallen on his head some years previously, and had subsequently suffered from deafness."

Professor Moos found lymphoid corpuscles on the lamina spiralis, on the saccali and ampullæ, some having undergone fatty degeneration, in the labyrinth of a soldier who had died from typhoid fever. "Fatty metamorphosis of the organ of Corti may also be the

* "Lancet," p. 417, March 24th.

result of hemorrhages into the cochlea." Amyloid degeneration of the auditory nerve is not uncommon.*

With regard to the treatment of this form of deafness, if the case arises from recent injury to the head, or other cause offering strong evidence of effusion of blood having taken place, leeches, purgatives, and counter-irritants may be resorted to; for it is within the bounds of possibility that absorption may be thus facilitated;† but if the disease have become chronic, no treatment will be of use, the administration of quinine, for instance, doing more harm than good; and I have never seen any beneficial result, at any rate, as far as the hearing goes, from the use of electricity. Ice bags applied to the head in typhoid fever, I believe to be a frequent source of mischief to the labyrinth; therefore, such applications should be used with great caution. Extreme cold of any kind, such as a continuous draught of cold air, is not uncommonly the starting point of this form of ear disease. It may originate in an attack of mumps, in which case one side only is usually implicated.

I have lately had a case of this kind in a young gentleman where no sign of mischief could be detected in the membrana tympani. The mumps had attacked him sharply three months previously, and had left him quite deaf in one ear, and at present there seems very little hope of amendment.

84. *Nervous Deafness after Typhoid Fever.*

E. H., a girl, æt. 10, was brought to me at the hospital totally deaf, the consequence of typhoid fever; and as this had occurred

* "A Treatise on the Ear," by C. H. Burnett, M.D., p. 593.

† See case of injury to head, p. 181.

when she was two years old, there was accompanying dumbness.

At the time of the attack she had been able to hear and talk as well as any child of her age, but her knowledge of speech was too slight to be permanent. Her general health had completely broken down. I prescribed,

Potassii bromidi gr. iij;
Tinct. nucis. vomicæ ℥ ij;
Aquæ. ℥ ss.
t. d.

And cod-liver oil occasionally.

She has now been under my care for some time, and a slight gradual improvement has taken place, both in hearing and power of speech.

This case is scarcely typical of nervous deafness. Yet I mention it here as being very nearly allied to the class under consideration, and it teaches us to be guarded against giving an unfavourable prognosis in cases which so closely simulate affection of the auditory nerve. I agree with Burnett in thinking, that in the vast majority of cases of deafness due to typhoid fever, the affection of the labyrinth is secondary to a tympanic disorder.

It is, of course, extremely common to find deafness more or less severe, occurring during the acute stage of fever, especially typhus; and this is *always* commensurate with the amount of nervous prostration induced by the fever, and the severity of the other nervous symptoms. Most commonly as convalescence approaches, this passes off, but occasionally it is prolonged for some time subsequent to renewal of health, and in some cases it is permanent. It thus closely resembles the more extensive injury to the nervous system, occasionally occurring and resulting in melancholia or mania, which in like manner may be either temporary or permanent. Loss of the other special senses is much

more rare, so also is motor paralysis, but cases of these nervous lesions are also reported.

In epidemic cerebro-spinal meningitis,* "the deafness is said to be due to inflammatory changes set up in the organ, particularly affecting the lining membrane at the vestibule and semicircular canals. Occasionally the external meatus has been affected, and a profuse purulent discharge has flowed from it."

Dr. Buchanan states that deafness generally begins in typhus at the end of the first week, "being slight, or nearly complete in amount, and persisting even after the advent of convalescence. Nothing is to be seen in the ear to account for it."

85. E. D., æt. 19, came to the hospital from Walton to consult me last January. She had been deaf for ten years after typhus fever. Could not hear my watch in contact with either ear, neither could she hear my voice. Her mother was the only person who could make her understand anything. This patient could hear a tuning-fork placed on the vertex of her head. The membrana tympani in both ears was concave, thickened, and of a dirty grey colour; the Eustachian tubes were completely closed. For the last eighteen months she had been gradually losing her speech, and was almost dumb. With a little difficulty I passed the Eustachian catheter, and continued to do so regularly once a week, and afterwards once a fortnight; and at the same time gave her large doses of iodide of potassium. Under this treatment she improved considerably, her speech came back by degrees, and six months after I first saw her she could talk perfectly well, and although still very deaf, anyone, by a little extra exertion, could make her hear. She could understand perfectly what I said to her. I could see very little difference in the colour and shape, &c., of the tympanic membranes.

Of course there were great difficulties to contend with in this case; the sound-perceiving and sound-conducting apparatus were

* J. N. Radcliffe in "Reynolds' System of Medicine," vol. 1, p. 505.

both at fault ; but by improving the condition of the latter the auditory nerve was enabled to use what little power it had left, and by this means she was prevented from becoming dumb as well as deaf.

There are several—perhaps many—cases on record of almost complete recovery from what at first appeared to be incurable deafness after typhoid and other fevers, or from injuries to the head. These are instances in which it is very difficult to make at once a correct diagnosis ; and I would make it a rule never to come to a hasty decision, but to treat every such case upon the chance of the disease not having permanently injured the nerve apparatus.

There is a close connection between the vascular structures of the tympanum and labyrinth, and consequently in cases of deafness after typhoid and puerperal fevers, &c., the hyperæmia of the labyrinth is often only temporary, and accounts for those cases I mention, where leeching and blistering freely behind the ear at once relieves the deafness. A glass of spirits will likewise in some people cause temporary deafness from the congestion, extending (as Burnett suggests) from the fauces, to the Eustachian tube, the middle ear, and so on to the labyrinth.

LABYRINTHINE DISEASE, SUPERVENING ON DISEASE OF MIDDLE EAR.

In these cases the power of hearing is very dull, but not always lost ; and upon improving the condition of the conducting structures, amelioration of the symptoms will take place. Perfect hearing hardly ever is regained when the labyrinth has been thus involved, but by clearing and repairing the road to the inner ear,

we enable our patient to make use of the little power of hearing left to him.

86. *Sub-acute Inflammation of Middle Ear, of Both Sides. Complete Closure of Eustachian Tubes, with Extension of the Disease to the Labyrinth, originating in Severe Cold.*

C. H., æt. 58, came to the hospital August, 1875, complaining of loss of hearing in both ears, of several years' duration. Deafness had been getting gradually worse since the cold, which was caught from sitting at an open window.

I found that she could not hear the tuning-fork vibrated close to outer ears. The tympanic membranes were dark-brown in colour, and sunken inwards. I could not converse with this patient in the slightest degree, except through an ear-trumpet.

I removed the obstruction in the Eustachian tubes, and gradually improved the condition of the middle ear, and was extremely gratified at the result, there being a decided improvement in the hearing; which, in such a bad case, was very satisfactory.

No alteration took place in the condition of the auditory nerve, but the slight power left in it could be utilized.

87. *Chronic Catarrh and Slight Deafness for many years. Subsequent Sunstroke caused great increase of Deafness, implicating the Nerve Apparatus.*

A gentleman who had been British Consul in the Holy Land was sent to consult me by Dr. Handfield Jones, August 11th, 1877. He could feel the vibration, but could not hear the tuning-fork when placed upon his head. Could not hear the watch in contact with either ear. He could hear a little in the right ear when he placed his hand behind the ear, or used a speaking-tube; but on the left side he was totally deaf.

In this patient, by taking a course of tonics, by getting the mucous membrane of his throat into a healthy condition, and by using Politzer's bag twice a week, his hearing improved considerably. He was thus enabled to hear my watch tick at a few inches from his right ear, a sound that he had not been able to hear for seven years.

88. *Deafness from Sudden Concussion.*

Mr. B. came under my care September, 1876. He had been slightly deaf for many years; could hear my watch 2 inches

right side, 4 inches left. He stated that while standing near a big gun it was fired—unexpectedly to him—after which he was deaf.

I found that there was extreme concavity of both tympanic membranes; they had been blown forcibly inwards without rupture. I used Politzer's bag, which relieved him instantly; and on subsequent treatment gradual improvement took place, notwithstanding the permanent injury to the labyrinth which he had sustained from the shock. Such accidents are not uncommon, the *membrana tympani* being seldom ruptured, unless there should happen to be obstruction in the Eustachian tube.

Artillery men and boiler makers, who are so frequently exposed to shocks of concussion, are liable to chronic inflammation of the internal ear coming on gradually, but they seldom suffer any sudden injury; and perhaps this may be attributed to their hardly ever being taken by surprise when a gun is fired or a blow is struck; for it is probable that by the action of the internal muscles of the ear, especially the *stapedius*, the parts are placed in a position favourable to the reception of such shocks. We all know how much less we feel the shock of a great noise if we know that it is going to take place.

If boiler makers and others who are exposed to continual noise, would only take the precaution of wearing cotton wool in the ears, they would effectually prevent concussion and chronic inflammation of the internal ear.

In some instances considerable loss of hearing comes on quite suddenly without any apparent cause, and without warning of any kind. Such was the case of a medical man, Mr. J. W., who consulted me January, 1878, who could not hear a watch in contact with either ear, nor the vibrating tuning fork when placed on his forehead. He derived little benefit from

treatment, and a year afterwards thus describes his symptoms:—

“If you ask me how I now am in respect to deafness, I should say *in statu quo*, neither better nor worse. The noise varies much in the course of the day, with cold or damp, or digestion, or wet. My general health is excellent. There was, and still is, if you remember, a subsidiary noise, not apparently located in the ear, but in the cerebellum. This is still the same, and just as I drop off to sleep I suffer a nervous shock or start, which, however, is not repeated so as to keep me awake.”

I lately saw a case with Dr. Hood, of sudden loss of hearing and severe tinnitus aurium, which was brought on in rather a remarkable manner.

A gentleman happened to be passing through a poor neighbourhood, and came to a house where brokers were about to seize an old widow's furniture for a debt of some £30 or £40. After making enquiries, he paid the amount due; but was so overcome with emotion caused by the distress he had witnessed, that he was seized in a moment with sudden and almost total deafness in one ear.

It seems difficult to draw a line where such cases end, and where auditory vertigo, or Ménière's disease, or labyrinthine vertigo, begins. According to Dr. Knapp, Ménière's disease is an “idiopathic serous exudative otitis interna.”

There are many theories assigned for the cause of the disease. According to Dr. Hughlings Jackson there are two sets of symptoms:—

(a.) Vital (faintness, perspiration, irregularity of pulse, &c.).

(b) Locomotor (vertigo, with or without reeling).

He attributes the former to disturbance of, or actual disease in, the cochlear division; the latter to disease or disturbance of the semicircular canal division. The vital and locomotor symptoms are due to disturbance of the medulla oblongata and cerebellum respectively.

Roosa,* on the other hand, says: "These cases have the usual history of what we may suppose to be effusion into the labyrinth, that is, nausea, vomiting, vertigo, and inability to walk straight, with sudden deafness. There was an autopsy in one case of Dr. Ménière's. This, however, was not a true specimen of the cases from the clinical history of which Ménière made his diagnosis. It was that of a young woman who, while menstruating, caught cold and became suddenly deaf. Her chief symptoms were vertigo and frequent vomiting. Dr. Ménière examined the ears, and found all the parts healthy except the semicircular canals, which were filled with a reddish plastic substance, replacing the labyrinth fluid. The vestibule also exhibited traces of this exudation, but the cochlea, brain, and spinal cord were normal." Again, he says: "I prefer to say disease of the cochlea, instead of disease of the labyrinth, when the prominent symptoms are great impairment of hearing, the inability to hear certain tones, and the production of false ones. These are evidences, I think, of cochlear disease, whatever else we may have. Tinnitus is a symptom common to many forms of aural affection, while vertigo and unsteadiness of gait are chiefly to be referred to undue pressure from the base of the stapes upon the semicircular canals, and not to disease of the cochlea.

* "Diseases of the Ear," 4th edition, pp. 494-525.

I think too much stress has been laid upon increased pressure upon the latter-named part of the ear, to the neglect of disease having its origin in the tone-perceiving apparatus—the cochlea. Ménière's disease has always seemed to me an unfortunate name, since it has been indiscriminately applied. It ought not to be used unless it refers to a case such as that in which a hæmorrhage into the semicircular canals was found. Of late, cases in which the cochlear symptoms are at least the predominant ones, are sometimes styled cases of 'Ménière's disease,' when they have very little in common with cases of hæmorrhage."

There are again cases which one meets with in practice where the vertigo is distinctly to be traced to ear disease, but in which the deafness is not so absolute, and when treatment appears to be of much value.

These cases I believe to be more numerous than is generally admitted, from the fact that numberless patients with ear mischief giving rise to reeling, faintness, &c., are very frequently treated for derangements of the stomach. I will give, as shortly as possible, cases in point.

89. T. F., a postman, æt. 41, was admitted into the Thistlethwaite ward, November 14, with a slight discharge from the left ear, and constant giddiness. If the ear was pressed he was seized with giddiness and vomiting, falling always to the right. He stated that when walking in the street attacks of the kind frequently came on; that he became giddy; but as he invariably fell to the right side, he was able, in some measure, to guard against an accident. The discharge was treated with various astringent lotions, and he was ordered 20 grains of bromide of potassium three times a day, and counter-irritation behind the ear. Under this treatment he gradually improved, the attacks became less frequent, and in a month's time he left the hospital, apparently well.

90. A gentleman had suffered for eight years with tinnitus aurium, occasional giddiness, and with a reeling to and fro whenever he went out, and so much so latterly that people in the street were constantly under the impression that he was drunk. He consulted a great many medical men, who all told him that his trouble arose either from derangements of the liver or stomach, until he came under Dr. Broadbent's care, who at once discovered ear mischief, and sent him on to me. He heard the watch 3 yards right ear, 2 yards left, and the tuning-fork very indistinctly and for a very short period. He had had a slight discharge from one ear once or twice during the eight years. Says he does not reel particularly to one side when he is out, thinks sometimes one way, sometimes the other, but is not certain. During these attacks he finds the only thing that at all steadies him is by stamping one foot repeatedly on the ground. The tympanic membrane looked perfectly healthy. He was treated as in last case.

I saw this patient recently, when he told me that he was so much better that he had quite got over his *bête noir*, which was crossing London Bridge. He said he could now get over with confidence, and without dread of falling, which had not been the case for years.

91. T. H., æt. 34, came to the hospital October 26th, 1878. He states that he was first seized with fits about seven or eight years ago, and deafness in the left ear; till then had enjoyed fairly good health. The fits would come on gradually with a feeling of giddiness and dizziness in the eyes, followed by an inclination to fall down to the right side, against which he struggled. The patient had been a temperate man, but used to indulge freely in smoking. He strove hard against these symptoms, but without success, sometimes being attacked two or three times a day. The fits were more liable to come on in the streets when he was by himself than at home, where he felt safe, and was not so much troubled by them. About the time of seizure he used to suffer from very bad head-ache, otherwise he was fairly well, and was not much troubled with deafness. After having sought relief in vain for a considerable time, he came to St. Mary's Hospital, and was treated with bromide of potassium, which he has been taking ever since, in gradually increasing doses; at the present time he takes ʒss three times a day.

After a few weeks' treatment he was greatly benefited, and

three months ago was able to walk about with more confidence; now he rarely has the attacks at all.

In these cases I have found that very considerable relief may be given from counter-irritation behind the ears, and by administering large doses of the bromide of potassium. Dr. Gowers suggests that this drug is useful in those cases where "any undue sensitiveness of the grey matter of the equilibrial centre must be lessened." In these cases it had a remarkably good effect. The noises in the ears diminished, and they were able to get about without the continual dread of falling down.

According to one of the latest writers on therapeutics,* "bromide of potassium exercises a powerful influence over the nervous system; the nervous arrangements of the circulation are affected by it, and the action of the heart is lowered by large doses. It, as well as bromide of ammonium, possesses a very marked power of diminishing nerve activity; and even still more in arresting nerve conductivity, so that in all cases of action of reflex origin it is invaluable." Whilst according to the same excellent authority, "quinine dilates the cerebral vessels, and produces vascular congestion of the contents of the encephalon, and is most useful in cases of nervous exhaustion."

Professor Charcot has lately recommended this drug in cases of auditory vertigo.

The following is a case where much benefit was derived from its use:—

92. M. J., 40 last birthday, was admitted into St. Mary's Hospital on October 1st. She has been deaf off and on for about

* Dr. Milner Fothergill, "Practitioners' Handbook of Therapeutics," 1878.

12 years. She stated that about 12 years ago she was very much worried about business matters, and it was then that she was first seized with a fit; she fell suddenly down before she could put out her hands to save herself. She had two attacks within the space of a few days, and was then free from them for 12 months; from that time she has been constantly attacked by them, more especially so during the last two years. Before the fit comes on the patient generally has a noise in her ears, and a feeling of pins and needles in her extremities; she also describes a fluttering in her heart, all in a moment she falls forward down to the ground, being perfectly sensible at the time; if her head is kept up she recovers sooner. Her state of hearing varies considerably. On October 12th she was able to hear a watch ticking at the distance of 6 inches with her right ear, and 12 inches with her left. She could hear the tuning-fork. Lately, before she sought advice at the hospital, she has been afraid to go out of doors, having sometimes as many as four fits in the week. She was ordered 5 grs. of quinine three times a day, and has been taking this medicine for a week. She feels much better, and her appetite has improved considerably for the first day or two after taking the quinine. She has had the feelings as if the attack were coming on, but has not fallen down, during the last two or three days even these symptoms are gradually disappearing, and she is now merely suffering from slight tinnitus aurium in her left ear.

October 23rd. Is still better, and has had no more attacks since last week.

The next is a case of double Ménière's disease, and was relieved by doses of hydrochloride of ammonia, after all other treatment had failed.

93. In October, 1877, G. B., æt. 60, came to St. Mary's Hospital. For eight years previously he had been suffering from fits, having sometimes as many as two or three a day. During this long period he had sought relief in vain, and he had been treated for general nervous disorders.

He first saw Dr. Handfield Jones, who kindly sent him to see me. He had been suffering from deafness in both ears for several years. The patient states that he felt unwell for a day before an attack of giddiness, and any little excitement was sufficient to

send him off ; when attacked by a fit, unless he sat down and held fast to something he would fall down directly forwards. The fit might last from 5 to 15 minutes, he being conscious during the whole time, and feeling much relief when the seizure had passed by. He was generally attacked in doors ; rarely in the streets.

The patient has been subject to deafness and tinnitus aurium in both ears all his life ; but otherwise has enjoyed fairly good health.

He was ordered—

R. Ammoniã hydrochloratis	gr. xii.
Tinct. nucis vomicã.....	℥ v.
Aq. add	℥ i.

ter in die.

In the early part of the spring of 1878, patient began to feel decidedly better, sometimes going a whole week without having a fit. Ever since July he has been perfectly free from the attacks, and, with the exception of temporary feelings of nervousness, is quite himself again.

There are cases on the other hand which seem to defy all treatment, but I shall not go further into the subject here, and must refer the reader to other portions of the work for fuller details as to the action of drugs on the cerebral circulation, &c.

94. *Injury of the Head ; Probable Fracture of the Base of the Skull, followed by Deafness.*

H. M., æt. 20, was admitted under the care of Mr. James Lane, on December 5th, 1877. He had fallen from a height of 12 feet, and struck his head against some stone steps. He was picked up insensible, bleeding from the nose and mouth.

On admission, he was partially conscious, but in a state of extreme collapse. There was no wound, and no outward evidence of fracture, but great ecchymosis of left eyelids, and also beneath the ocular conjunctiva. He recovered by degrees from the collapse, and then vomited a considerable quantity of blood. When raised from the pillow blood again flowed from the nose. During the night he was violently delirious, trying to get out of bed ; but he could understand what was said to him, and would do what he was told. For the next two or three days he lay in a torpid condition, his head buried in the pillow, and his knees drawn up

towards his chin. The torpor was varied by occasional fits of restlessness and irritability, and he complained of severe pain in the head. During this period he several times vomited a quantity of blood. There was no paralysis, and no elevation of temperature or other sign of inflammatory action. The pulse was never more than 70, and once was as low as 40. He was now found to be quite deaf in the right ear, and partially so in the left.

The further progress of the case was satisfactory. No other unfavourable symptoms were observed. The drowsiness and headache gradually passed off, so that at the end of four weeks he was able to get up and walk about. He was, however, still completely deaf in the right ear, though the hearing on the left side had much improved.

The treatment pursued was simple. It consisted of free purgation in the first instance, with cold applications to the head, perfect rest, and avoidance of excitement from the visits of friends, or otherwise. Afterwards the compound iron mixture was given as a tonic.

In some clinical remarks on this case, Mr. Lane gave the following explanation of what he believed to have taken place. He thought there had been fracture of the anterior fossa of the base of the skull, implicating probably the orbital plate of the frontal bone on the left side and the cribriform plate or cells of the ethmoid, and perhaps the sphenoidal sinuses. Such a fracture would account for the great ecchymosis in the left orbit and eyelids, and for the bleeding from the nose and mouth. It would also explain the vomiting of blood during the first few days; for as the patient lay in bed, the blood would pass into the pharynx, and be swallowed insensibly and rejected at intervals. This continued oozing of blood through the fracture had, he thought, been of great service in preventing injurious compression, and consequent paralysis, and also in warding off the tendency to intra-cranial inflammation. The head symptoms which were observed depended, he believed, rather on "cerebral irritation" than on either of the conditions just mentioned, and were probably the result of bruising, and perhaps slight laceration, of the brain substance in the immediate vicinity of the fracture. There was no bleeding from the ear to indicate fracture of the petrous portion of the temporal bone, and so account for the deafness; but he remarked that it was not impossible for such a fracture to take place with-

out rupture of the membrana tympani, in which case there would be no bleeding externally, but effused blood might find an outlet through the Eustachian tube into the pharynx.

The urgent symptoms having all subsided, Mr. Field was consulted with respect to the deafness, of which he undertook the treatment.

On January 2nd the patient was unable to hear the ticking of a watch in contact with the right ear, and, as there were no signs of injury to the membrana tympani, the deafness was thought to be probably due to effusion. Blisters were applied over the mastoid process, and six leeches in front of the tragus. Three grains of iodide of potassium were given three times a-day. Under this treatment his hearing gradually improved. On January 6th he could hear the watch 5 inches from the right ear; treatment continued. In ten days' time he could hear at 36 inches, and at the expiration of a month his hearing was restored.

“ With regard to the treatment of this case by counter-irritation behind the ear, Mr. Field stated, a few words of explanation were desirable. Although Toynbee adopted this practice largely, it has been the custom of late to cast some doubt upon its efficiency, and at first sight it is not very evident how a blister outside the skull can affect such distant and deeply-seated structures. Although the action of counter-irritation is as yet far from being explained by physiological therapeutics, and a cloud of contradictory witnesses have been summoned by writers on the subject, who as yet have only succeeded in obscuring the true interpretation of what appears, at first sight, a simple and very common subject of observation; nevertheless, two main facts stand out prominently for our guidance as the result of clinical experience, namely, first the teaching of ages has shown that, whenever we desire to effect the absorption of effused serum, no remedy is so successful as counter-irritation; secondly, more modern practice has demonstrated beyond a doubt that the application of cold to

the surface relieves internal congestion, and is perhaps the best remedy in cases in which we have to combat inflammatory action. Nor are these two facts in contradiction with the great physiological truth first taught by Hilton—namely, that the blood-vessels of the skin sympathise, by means of their vaso-motor nerves, with those of the organs beneath. For we learn clinically that the irritation of a blister on the skin of the thorax produces a similar irritation of the vessels of the pleura, with a change of nutrition in both parts of the same nature, but not to the same degree. So also we see the contraction of vessels on the skin of the abdomen brought about by ice-bags, applied in cases of hæmorrhage from the bowel in typhoid fever, produce a sympathetic contraction of the vessels of the intestine. In like manner the blister behind the external ear affects the nutrition of the internal ear. The reason of this is not far to seek, when we consider that the posterior auricular branch of the external carotid supplies alike both the internal ear, by the stylo-mastoid branch, and the external ear by the auricular; the vaso-motor nerves on each of these vessels being continuations of those on the posterior auricular itself, and therefore branches of one sympathetic plexus. From these considerations the importance of the exact pathological condition with which we have to deal is made very evident: thus while counter-irritation, in a condition in which the absorption of effused serum is required, proves of great benefit in such a case, the application of the ice-bag would be most prejudicial to the patient. Moreover it is commonly observed that intense cold is a frequent cause of nervous deafness. Leeching was recommended, in the hope of relieving great turgescence of the

blood-vessels of the part, should such a condition exist, with a view of facilitating the action of the blister on the vaso-motor nerves, which might have been otherwise impeded by the over-fulness and consequent mechanical dilatation of the blood-vessels. It is important that treatment should be employed early in these cases, because after the lapse of two months or so, hopes of a successful termination are small, in consequence of the organisation of the effused products.*"

The next is an extraordinary case, and bears out the remarks I have just made. Steps had been taken to place this patient in a deaf and dumb school, but, after a profuse discharge of pus had been brought about by plugging up both ears with sponges, with the idea that dilatation might prove of benefit, his hearing gradually came back. The external meatus was not dilated by the process, but as long as the discharge of pus lasted, his hearing slowly but gradually improved.

95. J. E., a medical man, æt. 29, always enjoyed good health. Parents, first cousins, are living. As a child, a suspicion of deafness arose, which led to experiments. A pistol was discharged close to him, which did not attract his attention. The same experiment repeated while he was asleep awakened him, and he appeared startled. When he was seven years old, his father made inquiries about a deaf and dumb institution. Before arrangements were completed, one day as the boy was standing on the door-steps, the hall door banged, at which he screamed. From this time he began to hear a little. He was now brought to the late Sir William Wilde, an eminent aurist in Dublin, who said nothing could be done. It was proposed to dilate the meatus with prepared sponges, which was done. They were removed at the end of about a month, a thick discharge continued to pour away from the ears for some time afterwards, and the hearing gradually improved. Some time after an abscess

* The "Lancet," March 30th, 1878.

formed in the left ear, which caused considerable pain. The hearing improved every year till he was twenty. When he consulted me in January, 1878, he could hear fairly well ordinary conversation, but he could hardly distinguish the vibrations of the tuning-fork when placed on his head.

In some severe forms of neuralgia and tic-douloureux, the hearing is liable to become affected. According to M. Notta, out of 128 cases of trigeminal neuralgia, the sense of hearing was impaired in four cases.

As I have said before, some cases of deafness may occur without any very definable cause; this is especially the case in women, in whom, sometimes, very slight shocks, caused by distressing news, will give rise to sudden deafness.

A patient came to me at St. Mary's a short time ago with almost total deafness, which came in a moment, after hearing of the death of one of her children.

These cases are difficult of explanation. They are similar to those instances of sudden nervous attack, in which the hair is said to turn white in the course of a few hours.

Another instance came before me a few months ago in which a bootmaker suddenly lost his hearing when his wife died.

Pregnancy and suckling sometimes seem to take a part in causing deafness. A lady consulted me the other day who always becomes deaf four months before a confinement, and gradually recovers after giving up suckling her child; and there are many instances on record of women whose hearing becomes affected, while suckling their children.

The following is an instance of the effect of sudden shock on the offspring, and not affecting the mother:—

96. K. P., æt. 2, deaf and dumb, was brought to see me at the

hospital, March, 1878. Her father who brought her stated that the eldest of his six children was born perfectly healthy, but the mother, four or five months before the second child was born, met with severe fright from the house being on fire. The five children that were born subsequently are all deaf and dumb; the father did not marry a near relative, and both parents are in good health. Most of the children were brought to see me, but they were all incurable.

Bilious attacks, commencing with nausea, giddiness, &c., may cause sudden loss of hearing, and this is probably the result of the poisoned state of the blood, as it may be also in deafness, concurrent with gout, syphilis, fever, &c.

Hereditary syphilis is a common cause of nervous deafness. It makes its appearance generally between the tenth and sixteenth years, and is more common in females than in males. It is generally associated with an inflammatory affection of the eyes, known as chronic interstitial keratitis. Mr. Hinton, at Guy's Hospital, found that these cases furnished more than one-twentieth of the aural patients there. He thus described the appearance of the *membrana tympani*, &c. "On examination it is found that a tuning-fork placed on the head is heard for a very short time, or not at all; the meatus is free from wax; the *membrana tympani* looks somewhat white and rough; it may be flat or too concave, but it generally has a dried-up look, as if its juices were deficient. The throat is by no means always unhealthy. The peculiarly harsh sound produced by passing air into the tympanum suggest the presence there of rough lymph, or [the almost total deafness proves that the labyrinth has suffered." He recommended scruple doses of hydrochlorate of ammonia.*

* Supplement to Toynbee's "Diseases of the Ear," p. 461.

A large number of these cases, mostly females, have lately been under treatment at the hospital.

97. A girl *æt.* 16, now in the Manvers ward, is a typical case. Three years ago she suffered from an inflammatory affection of the eyes, followed shortly afterwards by ear disease—in fact, her eyes and ears have alternately been more or less affected. Her teeth are very jagged, and are highly suggestive of inherited syphilis. The medical man who sent her to St. Mary's informs me that she is one of a family of eleven, and that nine of her brothers and sisters died before they were four months old. The eldest child, however, is still alive and healthy. The father is described as being "very fast and wild." The tuning-fork is very indistinctly heard for a short time, and the watch only in contact with one ear.

In cases of this kind various modes of treatment have been adopted without any satisfactory improvement. Mr. Hutchinson, seventeen years ago, in an admirable clinical memoir on "Certain Diseases of the Eye and Ear consequent on Inherited Syphilis," drew the attention of the profession to this subject. Many patients that I have treated, including the girl now in hospital, who seemed to be almost on the point of getting well, have rapidly sunk back again to a state of hopeless deafness. In some instances absolute loss of hearing takes place in a very short time; for hereditary syphilis is of all diseases the most rapid cause of complete deafness, and is also the least amenable to treatment.

Much good, however, might be done if preventive measures were more frequently taken in cases where we suspect a syphilitic taint. That is to say, we must endeavour to eradicate the disease by judicious treatment before the child is ten or twelve years of age; and we should not so often hear of interstitial keratitis

and its accompanying deafness. A great authority on this subject has lately written,* "frequently the child is born apparently healthy, but the ordinary train of symptoms sets in a few weeks after its birth. These children under judicious treatment very frequently recover."

Tumours occasionally attack the auditory nerve; they are usually either fibrous or sarcomatous. The following is one of the latter class:—

INTRACRANIAL SARCOMATOUS TUMOUR IN CONNECTION WITH THE
AUDITORY NERVE.†

98. E. J., æt. 29, was admitted into St. Mary's Hospital January 29th, 1877, under Dr. Broadbent's care. History imperfect. Has suffered from pain in the head and vomiting, and recently vision has been failing. Complains of her head throbbing; says that she saw very little yesterday, and cannot see at all to-day. Has great trouble in swallowing. Is very deaf and slow to answer. Food trickles from corner of mouth. Pulse 75, feeble; temperature 97.5°. Is sick at times. Bowels open. Ordered a drachm and a half of solution of perchloride of mercury in an ounce of camphorated water three times a day.

February 3rd.—Rather better. Can see a little. Pain in the forehead; giddy. Marked paralysis of right side of face, and impairment of power in right limbs. Sensation about the same on the two sides. On ophthalmoscopic examination double optic neuritis was seen to be present in an advanced stage, with consecutive atrophy.

It was difficult to determine whether the deafness was due to defect in the auditory apparatus or to hebetude, and impossible to say which ear was the worse.

5th.—At 5 P.M. yesterday she became unconscious a short time. Made a roaring noise in the throat. Right leg drawn up. Right arm flexed and hand clenched. Right extremities generally rigid. Frothed at mouth.

* "Lectures on Syphilis," delivered at the Harveian Society, by James R. Lane, F.R.C.S.

† "Lancet," December 8th, 1877.

6th.—Fingers of right hand contracted. Sensation equal in both hands and on both sides of face and trunk. Tongue deflected to right side more than usual. Food clinging to the teeth. Left eye turned further inwards. Slept well. Complains that she cannot see at all. Pulse 76; temperature $98^{\circ}2$. Facial paralysis increased.

When the patient was made to walk it was seen that there was not merely dragging of the right leg, but a want of control over both lower extremities, and a vagueness in their movements highly suggestive of disease in the cerebellum. The cross paralysis—namely, of the sixth nerve on the left side and of the face and limbs on the right side—appeared to localise the cause as affecting the left side of the pons, while the ataxy of the lower limbs showed the cerebellum to be interfered with. The concurrence of pain in the head, vomiting, and double optic neuritis pointed to tumour as the probable disease; but it was difficult to understand how a tumour outside the pons should compress only the sixth nerve; and, had the morbid condition been in the pons, it could scarcely affect the nucleus of the sixth nerve without involving that of the seventh.

9th.—Rather better, but drowsy. Winks if a finger be put near the right eye, but the left eye may be almost touched without causing winking.

12th.—About 11 A.M. she had a fit, with gurgling in the throat; was unconscious about ten minutes; about 4 P.M. a second similar attack, lasting about the same time, occurred; about 7 P.M. a third similar fit. Skin cold during fits. Deafness increased; sleeps at night; cannot grasp with the right hand.

15th.—Looks better; complains of pain in the forehead, and is still more deaf; food and saliva hanging about lips and teeth. Temperature 98° .

19.—Last night fell into a torpid state at 6 P.M., and continued so until 4 A.M. About 11 A.M. she fell into a similar condition; lies on her back, with her mouth open; up and down movement of tongue; not roused by touching eyeballs; limbs extended; pulse 86, regular. About 9 P.M. she fell into the same kind of stupor till 4 A.M., and remained in a drowsy state; much more deaf; passes motions unconsciously; right hand almost powerless; articulation indistinct.

21st.—Has not been torpid again; answers slowly; urine

cloudy, sp. gr. 1031; face swollen, more especially on right side, but no pain in it.

March 1st.—Pulse 61; face very red; very deaf; irregular movement of fingers of left hand; temperature 79°; diarrhœa; urine contains mucus, sp. gr. 1024.

6th.—No diarrhœa; same condition as before, but rather less deaf.

8th.—Dark-red patches under both eyes; mouth rather more deflected to right side.

13th.—Not so well.

19th.—Torpid and semi-conscious; raves for her meals; breathing rather stertorous.

23rd.—Does not answer questions; passes motions in bed; left eyeball kept closed; right eye half open.

April 17th.—For the last month has remained very much in the same condition; she is quite blind and very deaf; cries out violently for food at stated intervals; the whole fundus of both eyes slaty in colour; the intellectual function is destroyed. On April 29th she died.

At the *post-mortem* examination, which was carefully made by Dr. Mahomed, a tumour of the size of a Maltese

PLATE I.

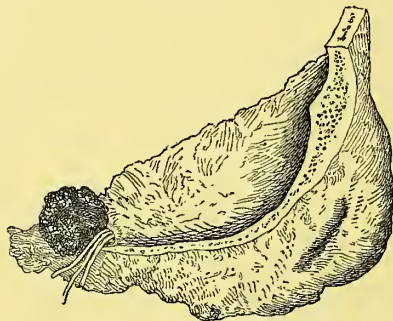


orange was found attached to the posterior surface of the right petrous bone,* just above the internal meatus.

* These pathological specimens were exhibited at the annual museum of the British Medical Association at Manchester, and

It was fissured and corrugated on its surface, like the cerebellum, and was of soft sarcomatous structure, not unlike brain-tissue on section. The upper margin of the medulla formed its posterior boundary. On examination of the petrous bone, the tumour was found to spring from the internal auditory meatus, taking origin apparently from the dura mater lining the meatus, and ensheathing the auditory nerve. The tumour did not extend into the meatus. On microscopic examination, the tumour proved to be a sarcoma. It consists of round-celled sarcomatous tissue (granulation sarcoma), which tends to arrange itself in whorls, in the centre of which blood-vessels are generally found. The contents

PLATE II.



thus described in the Catalogue :—Plate I. A cerebral tumour, which took origin from the process of dura mater ensheathing the right auditory nerve. It had compressed so as to completely flatten out, and apparently destroy, the right half of the pons Varolii, and also the right crus. It also compressed the right middle peduncle of the cerebellum. It consists of round-celled sarcomatous tissue — granulation sarcoma.—Plate II. Petrous bone, showing origin of the above tumour. It springs from the internal auditory meatus, taking origin apparently from the dura mater lining the meatus, and ensheathing the auditory nerve.

of some of these spaces could not be distinctly made out; they much resembled "giant cells." The tumour is very vascular; the vessels, however, have not thick walls. It presents the appearance of a tumour of moderately rapid growth; not so quick as in the case of most malignant growths, nor so slow as many benign ones.

Remarks.—This case is of interest both from its clinical and pathological aspects. I record it chiefly on account of its value as a rare lesion in connection with the auditory nerve. When it came under observation, the symptoms were too far advanced for a diagnosis of its exact origin to be possible.

According to Niemeyer, tumours of the brain causing hardness of hearing, or complete deafness from the destruction of the acousticus, is usually preceded, for a time, by troublesome noises in the ears.*

In conclusion, true nervous deafness is generally to be diagnosed by the use of the tuning-fork; but cases sometimes occur in which its indications are uncertain. No case should be considered irremediable until after due trial of remedies. Cases of partial deafness, superadded to disease of the middle ear, are to be relieved, but not cured. The whole class of nervous forms of deafness, it must be remembered, although an unfavourable one for remedial measures, is rare comparatively to other forms of loss of hearing.

* Niemeyer's "Text-book of Practical Medicine," translated by Dr. G. H. Humphreys and Dr. C. E. Hockley, vol. ii, p. 240.

CHAPTER XIV.

TINNITUS AURIUM.

SINGING IN THE EARS* is very frequently met with, being common to nearly all aural diseases, and is often a symptom causing much distress.

I can imagine nothing more painful, nothing harder to bear, than such a continual noise in the ears, as some unfortunate patients describe.

Roosa† mentions a case of a professor who consulted him on account of severe tinnitus aurium, and finding that he could get no relief, said, on leaving the consulting-room, that he would put an end to his existence; which he did shortly afterwards by blowing out his brains.

Kramer says, also, "I have known an instance of a man, once strong and healthy, who committed suicide to escape from a persistent and loud noise in the ears, which had lasted for many years."‡

Sauvage records an instance in which a musician was compelled to give up his occupation because he continually heard a second note inharmonious with every one he played.§ A very similar case—a lady sent to

* From a paper read by the author before the Harveian Society, April 15th, 1875.

† "Diseases of the Ear," p. 265.

‡ "The Aural Surgery of the Present Day," by Dr. W. Kramer, translated by H. Power, Esq., F.R.C.S., p. 19.

§ Holmes' "System of Surgery," vol. 3, p. 185.

me by Dr. Meadows—has come under my own observation.

1st. As to the cause, Sir William Wilde says:—"The peculiar character of the tinnitus and the noises to which it is likened, are as variable as sound itself; I think the descriptions which patients give of the noise which they experience, depend, to a certain degree, upon their fancy, their graphic powers of explanation, and not unfrequently, upon their rank in life, upon the position in which they have been placed, or the sounds with which they are most familiar; thus persons from the country draw their similitudes from the objects and noises by which they have been surrounded, as the falling and rushing of water, the singing of birds, buzzing of bees, and the waving or rustling of trees; while, on the other hand, persons living in towns, or in the vicinity of machinery or manufactures, say that they hear the rolling of carriages, hammering, and the various noises caused by steam-engines. Servants almost invariably add to their other complaints that they suffer from the "ringing of bells" in their ears. The tidal sound, or that which we can produce by holding a shell to the ear, is, however, most frequently complained of. Removing the cause and curing the deafness, will often, but not always, relieve the patient of the noise. It is often caused by cerebral disease: it is sometimes an accompaniment of derangement of the circulatory, digestive, or uterine organs; of congestion of the brain, hæmorrhage, hypochondria, hysteria, chlorosis, anæmia, typhus, influenza, or simple catarrh; of closure of the external meatus, obstruction of the Eustachian tube, and impaction of the auditory passage with wax. A foreign body, or even a hair resting on the tympanic

membrane; as well as engorgement of the lining membrane, or mucous collections in the tympanic cavity; and also nervous deafness: these will all produce it. So great is the discomfort which it gives, that persons incurably deaf, and who are quite conscious of the impossibility of restoring their hearing, will still apply to be relieved from this haunting and most annoying symptom. Overwork, prolonged suckling, taking quinine or iron in large quantities, a hearty meal, violent exercise, &c., &c., will often occasion it.”*

Galen thought that tinnitus aurium was due, in some cases, to exhalations from the stomach, and in others to increased sensitiveness of the ears.

The late Dr. Peter Allen wrote:† — “As chronic catarrh is the commonest form of deafness, so is tinnitus aurium the most frequent result or sign of it. It is dependent upon some abnormal pressure upon the nervous expansion in the labyrinth. The membrana tympani presses the ossicula inwards, and therefore the base of the stapes upon the fluid where the auditory nerve is distributed; or it may be so rigid, tense, and unyielding, that the secretions within the drum press unduly upon the still more delicate membrane of the fenestra rotunda. Thickening and great tension of the lining tympanic membrane do the same thing. When, in a case of aural catarrh, tinnitus and deafness are simultaneous in their commencement, they will increase proportionately; and it is obvious that in this instance both must depend upon some alteration in the conducting apparatus, by which its *acoustic* properties have been interfered with. For example, a little film of mucus spread over the inner side of the membrana tympani, is sufficient to alter the

* “On Aural Surgery,” p. 84. † “On Aural Catarrh,” p. 201.

periodicity of its atmospheric vibrations, or even partially to quench them. Thus deafness and tinnitus will co-exist here; but as soon as the removal or dispersion of the coating from the membrana tympani occurs, both symptoms will together instantaneously vanish. We are amply warranted by facts like these in concluding that the membrana tympani is generally, in some way or another, concerned in causing tinnitus."

"Next in frequency to interference with the membrana tympani, closure of the Eustachian tube is the most common cause of singing in the ears. This also, on analysis, proves to be such, not directly, but in the following manner:—A closed tube necessitates a too great curvature inwards of the membrana tympani, and consequently an abnormal pressure upon the nervous expansion within the labyrinth." And this is a most important point to observe.

Hinton, also, in his supplement to Toynbee's work, makes the following remarks:—"When of a beating character and synchronous with the pulse, it is obviously referable to vascular conditions as its exciting cause, and among others sometimes to aneurism of the basilar artery. In some cases, pressure over the course of the carotids immediately beneath the ear temporarily arrests it. In any such case, regard, of course, should be had to the condition of the heart. Some cases, when connected with headache, are said to be dependent on a weakened right side of the heart. Perhaps, however, the most frequent cause of tinnitus is pressure on the labyrinth, as illustrated by the sound heard on pressing on the membrana tympani with a probe. But in estimating the causes of tinnitus, it appears to me that the

* P. 462.

great frequency with which enlargement and fulness of the blood vessels of the labyrinth are found, on dissection, to accompany even slight inflammatory affections of the tympanum, should not be overlooked, and that it may be held probable that any considerable amount of tinnitus seldom exists without somewhat of morbidly increased irritability of the auditory nerve."

In a great many dissections made by Toynbee, Politzer, and others, this diseased condition of the labyrinth has been found; but on the other hand, a case is related by Mr. Dalby,* of a man residing at Trieste, "who had suffered for many years from tinnitus of so distressing a character that his life was rendered perfectly wretched. All the best aural surgeons in Germany had been consulted by him without any benefit. According to a request made in his will that his ears should be examined after death, a most careful dissection was made of the temporal bones, but no abnormal appearance of any kind was detected."

Tinnitus Aurium, it should not be forgotten, is commonly met with in patients suffering from chronic alcoholism; the noise is described "as a buzzing or rushing sound in the ears, and is frequently accompanied by dull diffused headache.†

We rarely find tinnitus present in cases of perforation from ulceration, and incising the membrane, no doubt, will afford relief, if a permanent opening can be established. All kinds of methods have been suggested to keep open the puncture, as I have already stated (p. 114).

* "Lectures on Diseases and Injuries of the Ear," by W. B. Dalby, F.R.C.S., p. 175.

† F. E. Anstie, M.D., Reynolds' "System of Medicine," vol. ii, p. 180.

Various other remedies have been proposed for this distressing symptom of aural disease. The hydrochlorate of ammonia, 20 grains, three times a day, is said to be efficacious sometimes; also glycerine and laudanum, applied warm to the meatus.

An eminent writer in the "Medical Times and Gazette,"* says:—"In some cases rubbing over the membrana tympani gently for a short time with a camel's hair pencil, moistened with any mild ointment, will—for a while, at least—remove the noise." And again, he says:—"If there is any medicine which acts specifically on tinnitus aurium it is arnica."

Triquet reports cases cured in a few days by daily injections of the vapour of chloroform into the tympanum.†

Kramer, again, affirms that tinnitus is in all cases due to irritation of the chorda tympani, and not of the acoustic nerve; and says that the repeated injection through the Eustachian catheter of a drop or two of a solution of strychnine—one grain to the ounce of water—will generally cure it.

In Holmes' "System of Surgery," the author of the paper on the Ear says:—"Of all medicines, a combination of quinine and morphia in small doses, taken perseveringly once or twice a day, seems the most useful. Stimulating liniments around the ears, perhaps containing chloroform, if tinnitus is a prominent symptom, are at least unobjectionable; and the free use of cold water and friction may in most cases be advised. I have never known any benefit produced by strychnia."‡

* Sir W. Wilde.

† Holmes' "System of Surgery," vol. 3, p. 185.

‡ The author has sometimes considerably lessened tinnitus in

He says:—"The drug may claim the position of a specific remedy for congestive labyrinthine conditions, provided always the auditory apparatus be first relieved of any well-marked morbid process which, by its presence, might tend to keep up excessive vascular action."

Dr. Woakes recommends hydrobromic acid,* and I have found it useful in those cases in which the noise in the ear is synchronous with the beat of the pulse, in doses of x to xv grains, three times a day.

Bromide of ammonium, ergot, digitalis, bromide of potassium (which I have found useful in several cases) have all been recommended: so have other more extraordinary remedies. A patient of mine at St. Mary's believed "a bit of dead eel put in the ear" to be "a capital thing for the buzzing noise." †

In some long-standing cases of aural catarrh in which tinnitus is very severe from "paralysis of the intrinsic muscles of the ear," the treatment I have found most useful is the application of faradisation directly to the tympanic membrane. I have had under my care many patients suffering from this form of tinnitus, whom I have relieved in this manner, after all other measures adopted had failed to afford the slightest relief.

Dr. Althaus, in his "Medical Electricity," says:—"all forms of electricity are able to rouse the vital energy of the auditory nerve, which responds to the some forms of nerve-deafness by the administration of a mixture containing quinine, morphia, and strychnia.

* "The Lancet," February 9th, 1878.

† Dr. Laurence Turnbull, of Philadelphia, very kindly sent me his pamphlet on Tinnitus Aurium (reprinted from the "Philadelphia Medical Times," June, 1874), in which there is very valuable information on the subject.

stimulus by sounds. I have always found the sound produced to be as near as possible to the note A.

“Dr. Brenner, of St. Petersburg, has made a most extensive series of researches on the action of electricity on the auditory nerve. According to him, the induced current is almost useless for experiments of this kind, because the rapidity with which the shocks succeed each other produces very unpleasant effects on the nerves of common sensation, without acting on the nerve of special sense. A specific response of the auditory nerve may nevertheless be obtained, but only by single closing or opening shocks from the induction apparatus, the opening shocks being the more effective ones. Some people perceive, when the power of the current is increased, a regular scale of auditive sensations, proceeding from humming to hissing, rolling, whistling, ringing, &c.; and some hear sounds with low power, but tones with high power.

“Brenner’s publications have given rise to an animated discussion, which was commenced by Dr. Schwartze, who pronounced Brenner’s statements to be altogether erroneous, and utterly devoid of value in a diagnostic, prognostic, and therapeutical point of view. He was answered by Dr. Hagen, of Leipzig, who confirmed Brenner’s statements in almost every particular; and by Brenner himself, who contended that Schwartze’s experiments of control had been made without any regard to the mode of experimentation recommended by himself, and were therefore worthless.

“A single shock from an induction apparatus produces a noise like a scratch; if the currents succeed each other rapidly, the noises do so likewise, and then resemble the buzzing of a fly on the window, or the

blowing of a distant trumpet. At the same time a sensation of pricking and pain is perceived, if the current be of high tension. The negative pole is more effective in the production of the acoustic phenomena than the positive."

Dr. Brenner, of course, is speaking of the benefit derived from galvanism in nerve deafness. I am not going to discuss this subject, but I agree with him in thinking that the continuous current is more likely to be of permanent service to the patient in this disease than the use of the induction apparatus. But with reference to electricity as a remedy for severe noises in the ear, I maintain that the good effect I have obtained is due to the stimulation of the intrinsic muscles of the ear, but I shall go more fully into this presently. And this stimulation, it seems to me, is carried on better with faradisation than with galvanism. I have made a number of experiments with the continuous current without any good results. I use Dr. Stöhrer's double-celled induction apparatus, and pass the current directly on to the *membrana tympani* by means of a vulcanite speculum, with a piece of platinum wire passed through it, which is attached to one of the wires of the battery. A silver probe brought into contact with the platinum is then used to carry on the current from the speculum to the tympanic membrane. This instrument is made by Messrs. Krohne and Sesseman, of Duke Street, W. At first it is necessary to apply a very weak current, which may be gradually increased in strength. Of course there will be pain experienced; but it is very slight if the shock is conveyed in the manner I have just mentioned. I have never, in a

single case, had any hæmorrhage, acute pain, or any serious result from the application in this way.

“The production of the peculiar sensation of taste, which is caused by faradisation of the drum of the ear, is due to stimulation of the trunk of the chorda tympani, which, after having emerged from the cavity of the tympanum through the fissura Glaserii, descends towards the gustatory nerve, in the sheath of which it enters, and then proceeds towards the tongue. Faradisation of the membrana tympani likewise produces contractions of the muscles of the tympanum.”*

I attribute the benefit derived in this form of tinnitus aurium entirely to stimulation of these muscles, just as in other parts of the body paralysis is often overcome by the same means.

Dr. Todd states† that “the muscular apparatus of the tympanic ossicles receives its nerves partly from the facial and partly from the otic ganglion; thus exhibiting an analogous arrangement to that of the muscular structure of the iris. Such an analogy renders it extremely probable that the action of the muscles of the ossicles are excited in a similar way to that in which the iris is prompted to act. The stimulus of sound conveyed to that portion of the nervous centre with which it is connected, excites by reflection the motor power of the facial nerve, which through its connection, direct or indirect, with the muscles of the ossicles, causes them to act, and the action is in proportion to the intensity of the sound, inasmuch as the more tense the membrane

* For further information I would refer the reader to Dr. Althaus' pages.

† “Cyclopædia of Anatomy and Physiology,” vol. ii, p. 576.

of the tympanum the less will be the excursions of its vibrations; as in the iris, the more intense the light, the more contracted will the pupil be."

99. The first case that I shall introduce is that of M. M., æt. 38, who came to consult me at the hospital, and who had been suffering from very severe noises in the ears for two years. They were almost unbearable at times. Both membranes looked unhealthy, dusky in colour, and concave; there was also obstruction of both Eustachian tubes. The Politzer bag was of no use, and the catheter did not relieve the noise in her ears, although it improved her hearing.

Had two distinct sounds, which she described, one like a steam-engine blowing, and the other a singing noise like a kettle boiling. Heard my watch 10 inches from the right ear, 1 yard from the left. Tuning-fork was heard best on the right side.

I then used Dr. Stöhrer's double-celled apparatus, and after a short time she said, "the engine noise does not seem so thick, and now it is more like a hissing." I went on with the faradisation until the blowing noise stopped altogether, her hearing also improved very much; the other, the singing sound, continued.

On my next hospital day she came again, and said she was much better. I repeated the faradisation; her hearing improved to 1 yard on the right side, 2 yards on the left.

The next day (February 24) she came to my house; I then applied the current to the membrana tympani by means of a probe passed through a speculum made for the purpose. Here the effect was much more marked; for a few seconds the second sound (that is the singing noise) entirely stopped, in whichever ear I applied the battery. A noise afterwards returned, but quite a different sound to what she had ever had before, and she exclaimed, "My head seems quite clear, and the noise is like a faint hurdy-gurdy; delightful compared to the other." She complained of a peculiar taste in her mouth, and said that the sensation in her ear was like pricking and scratching the drum of her ear with a pin. Her hearing improved 2 yards on the left side, and $1\frac{1}{2}$ on the right.

Next day the hurdy-gurdy sound still remained, but she said that after she had seen me yesterday the noise went away two or three times altogether, and it seemed quite strange to be

without it. Formerly she could not sleep at night for the noise, but now she got perfect rest. I kept the following notes of her progress:—

"February 26. Noise fainter, goes away at times; head much clearer.

"February 27. Still better; says that the hurdy-gurdy now sounds a long way off, and is getting fainter every day.

"February 28. I used the battery only to the membrane of the worst side, the right.

"March 1. Says that since yesterday the hurdy-gurdy sound has gone altogether from the right ear, but on the other side, in which I did not apply the current, she still hears the same sound very faintly. She also said, 'When I got up in the morning, I had to listen some time before I could make out the noise. It is a very long way off, and does not trouble me in the least.'

"March 5. Hurdy-gurdy noise gone, but has very slight blowing noise again in right ear, which went away after faradisation.

"March 15. Gradually improving, but occasionally hears a slight noise, but always a very long way off. Since then the noises have come back again, but they can always be relieved in the same way."

I may here mention that in a great many patients who have consulted me for singing in the ears, I have failed to observe any abnormal condition of the membrana tympani, and yet the noises were as loud and distressing as in the others, they also yielded readily to faradisation.

The next case is that of—

100. A. F., æt. 24, who had been deaf 14 years, with constant noise in her ears, which she said was like a steamer on the water, was very horrid, and so bad that she dreaded to go to bed. Heard watch 2 inches right side, 3 inches left; tuning-fork best in left. Here there was on both sides great concavity of membranes, with partial closure of Eustachian tubes, and fluid in tympanum. Faradisation was of great service; I applied it daily for a week. The "steamer noise" stopped, and never went on again. I saw her two months afterwards, and she had never had any return of the noise.

101. Mr. M., æt. 28, who had suffered from chronic aural catarrh for eight years, with deafness and severe tinnitus aurium, brought on from swimming under water, had unnatural concavity of both membranes, and when he first consulted me both Eustachian tubes were impervious. I constantly passed the Eustachian catheter; this treatment had a very beneficial effect on his hearing, but the noise remained.

He spoke of a sound "like a railway whistle heard coming into a station from a tunnel;" and of another sound like blowing in a bottle, both constantly going on.

After faradisation the "whistle" remained, but the blowing almost ceased.

The noises got less every time I used the battery. In fact the treatment was so successful that he bought a battery for himself, and I saw no more of him.

102. My next case is that of a lady who had been deaf for 20 years, with a noise (which had never ceased), like the roaring of the sea. There was nothing remarkable to observe about the case. I saw her once a week; she steadily improved under the faradisation; the noise was much less, and left her altogether at times. She fancied her hearing was better, but I could not detect much improvement myself in that respect. She, however, assured me that she was no longer troubled by tinnitus aurium.

103. The next patient, E. O., had been deaf 14 years, with constant severe tinnitus aurium like singing of a kettle and ringing of bells; both membranes of a dark grey colour; Eustachian tubes in healthy condition; heard watch 5 inches left, 4 right; tuning-fork best on right side. I treated this patient for a considerable time; but, although her hearing improved, the noise remained the same. I then applied the battery to the membrana tympani on both sides, and, after a short time, the sounds on both sides stopped for two or three minutes, and, when they returned, she said they were far off.

I used the battery five times; both noises entirely ceased, and she had no return of them.

104. Mr. C. came to consult me, March 18th, with deafness and severe tinnitus aurium. Said that at times the noise in his ears was most distressing, but varied, sometimes like one noise, sometimes like another, but the steam-engine sound gave him most trouble. Had been suffering from chronic aural catarrh for five years, with all the usual symptoms; there was great concavity of

both tympanic membranes. I saw this gentleman six times, March 18th, 20th, 25th, 31st, and April 5th and 10th. The noise had steadily decreased and became fainter every day. His hearing distance, when he came to me, was 1 inch right ear, contact left; and when I last saw him on the 10th of this month, it was 20 inches right, 18 inches left. He is still going on with the treatment.

Various noises are described by patients: in H. B. the sound is like a "noise heard in a stoneyard;" E. W., "hammering on something hollow, like an iron foundry;" M. C., "like meeting a lot of trains on the underground railway;" R. A., noise like "being in a forest, the wind blowing very hard through the trees;" J. L., "a hissing;" E. P., "like the swarming of bees;" S. B., like "knocking of basins together;" J. B., like "a fly buzzing in the ear." All these have greatly benefited from the same treatment, and many of them are, I believe, cured.

Faradisation, not doubt, stimulates the intrinsic muscles of the ear, and therefore enables them to perform their function. The stapes often remains fixed within the foramen ovale in certain cases of tinnitus.

Such a condition doubtless does, from the continued pressure of the stapes on the internal ear, induce a constant formation of false sounds. The partial withdrawal of the stapes, effected by contraction of the stapedius muscle, would be followed by a reduction or temporary removal of such false sound; and I would, therefore, suggest that, if this stimulation be carried on perseveringly, the muscle may regain its tone and exert its proper influence in the auditory function. This theory I think would help to explain some cases of so-called labyrinthian deafness which Mr. Hinton attributed to muscular spasm; for the recovery of hearing is often

perfect. The symptoms are often vertigo and paroxysms of tinnitus, the hearing improves during the intervals, and, finally, the hearing is restored when the fits of faintness, &c., cease altogether.

I have no hesitation in saying, therefore, that if the noises in the ears be due to paralysis of these small muscles, relief may almost immediately be obtained by closely pressing the sponges of the battery into the auditory passages; and that still more satisfactory results are effected by using the probe in the way I have already mentioned. I am bound to admit, however, that such results are not always lasting. I have had lately several patients suffering from very severe noises and to whom most satisfactory relief was given, but in a short time the tinnitus returned, to be again relieved by faradisation. One patient especially, who has suffered dreadfully from an unusually violent singing in her head, obtains ease in this way for four or five days, after which it returns as severely as ever; but can again be immediately stopped by the use of the battery.

There is another noise of a snapping character, said to be caused by contraction of the tensor tympani muscle, either voluntary or involuntary, or, as Politzer believes, by* "spasm in the palatal muscles, whereby the anterior wall of the mouth of the Eustachian tube is suddenly drawn away from the posterior wall, and the noise is thus produced and conveyed to the ear through the Eustachian tube. The ear of the observer also perceives the noise as coming from the ear of the person in whom the peculiar sound originates." The

* See "A Treatise on the Ear," by C. H. Burnett, M.D., Philadelphia, p. 441.

noise is exactly like the snapping together of the finger nails. I have not seen many cases of persons who have the power of voluntarily producing the sound, and only two in which the noise was involuntary.

The first, that of a maiden lady, æt. 50, Miss T., who consulted me in July, 1877, for a most distressing noise of quite an involuntary character, and which could be distinctly heard by other persons.

The other is the case of a medical man, Mr. P. M., who so correctly describes the noise that I give his own words. He says: "I have that intensely unpleasant crackling in the right ear when either I yawn widely or blow the nose, or shout, or clear the throat. Even a tap on the head produces it, or speaking rather louder than usual (as to a deaf person, for instance) produces a sharp crack in my ear. I suffer from it two or three hundred times a day at least. It is similar to snapping a percussion cap, only not so loud, or like tightening close to the ear a piece of wet parchment suddenly. Tinnitus I have had for years, and that is bad enough, but this snapping is unbearable."

And lastly, I would say a few words on abnormal vascular conditions affecting the organ of hearing and giving rise to various noises in the ears.

Very many cases come before one, in practice, of tinnitus aurium and deafness, in which, on examination of the auditory apparatus, no defect can be found therein, and we have to seek the cause elsewhere. This may be found in many, if not in most, of these cases to be due to certain vascular conditions, which I propose to consider here.

In the first place, I must once more draw attention to the extreme importance of a just pressure-equilibrium of the fluids and tissues of the internal ear; for but slight variations of either increase or decrease of pressure on these delicate structures may give rise to severe tinnitus. Anyone anxious to demonstrate the truth of

this remark may readily do so by pressing inwards the tragus of his own ear. The pressure thus produced by compression of the air in the external meatus, forcing inwards the drum, and by its means the chain of ossicles and the fenestræ, immediately produces severe tinnitus by the increased pressure on the endo-lymph and nerves of the cochlea—a result being produced exactly similar in its nature and effects to suddenly striking the keyboard of the piano, and setting in discordant vibration every note that it is capable of producing. The most common forms of tinnitus, such as are due to wax, polypus, or retained fluids in the tympanum, act in this manner; and I purpose to show that many less known, but no less important, cases of singing in the ears and deafness owe their origin to a similar but not so evident a cause. Anæmia and hyperæmia are powerful agents in modifying pressure-equilibrium. The high arterial pressure which occurs in Bright's disease is now well known, and is readily recognised by the character of the pulse. We have then, under these circumstances, over-filled arteries and arterioles exerting undue pressure on the peri- and endo-lymph, and giving rise to tinnitus. If we turn to other conditions by which we may test the truth of this observation, we become impressed with its great importance.

There are many well-known conditions of vascular hyperæmia and turgescence giving rise to tinnitus. It is frequently seen in those cases of hemicrania due to gout or other causes, in which dilatation, hyper-distension, and cord-like rigidity of the external vessels of the head may be readily recognised and examined. These may be taken as sure indicators of the condition of branches inside the cranium, coming as they do from

a common stock, and supplied by the same vaso-motor ganglia. Again, in venous hyperæmia due to heart disease, increased pressure, accompanied by tinnitus, is frequently produced; and we have a well-known and remarkable instance of a like and localised hyperæmia, which can be observed by means of the otoscope, as the result of an overdose of quinine or salicine—and probably alcohol has a similar effect.

In Bright's disease, where the tension is persistently high, the lymphatics probably regulate the quantity of fluid under the altered circumstances, and therefore tinnitus is not constantly present; it only requires, however, an exacerbation of the symptoms of the disease, and a further increase of pressure, to immediately develop the noises in the ear. A like explanation may be given of the tinnitus frequently occurring in those so-called bilious attacks, in which a careful observer often detects an increase of arterial tension. So also during an attack of gout, or in those conditions of plethora frequently culminating in apoplexy, of which the tinnitus may be often taken as a sure forerunner.

Thus far we have seen increased pressure to be the cause of this distressing symptom: the like result is produced by decreased pressure, and is seen in anæmia. In ordinary cases of anæmia, tinnitus is often both a prominent and distressing symptom, but never more so than when the anæmia is of recent and sudden production, as in cases of hæmorrhage, when, again, the change has been too rapidly produced to permit the lymphatics regulating the pressure of the peri- and endo-lymph.

This condition, too, is susceptible of ready demonstration by experiment. Firm compression of the

carotid immediately produces tinnitus in the corresponding ear.

It is not at all uncommon, especially in hospital practice, to meet with cases of chlorosis in young girls, in which tinnitus aurium is a prominent symptom. They come to get relief, not in consequence of a pallid face and suppressed catamenia, but from the constant annoyance of singing in the ears. We do not want the hæmacytometer to estimate the corpuscular richness of their blood, for the change in colour speaks for itself when improvement sets in.

So much, then, for vascular conditions without changes of structure occurring in Bright's disease. There are, however, other causes for the deafness which is not unfrequent in this disease. It is a well-ascertained fact that, owing to the high arterial tension and the disease induced by it in the walls of the vessels, minute hæmorrhages are apt to occur in various tissues of the body, especially the softer ones, such as nervous tissues and the mucous membranes. Hæmorrhages into the retina under these circumstances have long been remarked, and Dr. Mahomed* has recently described them in the brain-substance as a cause of uræmic convulsions. Their occurrence in the tympanum and other parts of the auditory apparatus as a cause of deafness in Bright's disease was first described by Schwartz, and since been frequently observed.

This, then, being the pathology of their condition, the indications for treatment are immediately apparent. Remedies which reduce arterial tension are necessary, and as these conditions are of a temporary nature, drugs whose action is rapid and also temporary are most suit-

* "British Medical Journal," July, 1877.

able ; thus I have seen jaborandi, nitrite of amyl, or a few whiffs of ether, all of which rapidly reduce arterial tension, prove serviceable. Cases of relief afforded by nitrite of amyl have lately been recorded by Michael and other German writers. In some instances, however, more certain and severe measures must be resorted to ; thus, in the case of a gentleman, Mr. T., aged 65, whom I lately saw in consultation, suffering from severe tinnitus, dependent evidently on an extreme condition of plethora and very high arterial tension, with a cord-like pulse—recognising the probability of a speedy attack of cerebral hæmorrhage, I advised the abstraction of 20 ounces of blood from the arm, a procedure which was attended with immediate relief from his distressing symptoms, and was probably the means of saving his life.*

In conclusion, whether the sound arise from cerumen, debility, chlorosis, aural catarrh, or other cause, if the treatment be thoughtfully adapted to the peculiar circumstances of the case, a cure may, as a rule, be hoped for. In aural catarrh, especially, judicious treatment by the Politzer bag, the Eustachian catheter and other appliances I have suggested, will, in the majority of instances, be found successful.

* From a paper by the author, in the "Medical Times and Gazette," June 8th, 1878.

CHAPTER XV.

ON THE GENERAL PATHOLOGY OF EAR
DISEASE.

IN a work on Aural Surgery, it is necessary to discuss in detail the treatment of the several morbid conditions of the organ of hearing, and to describe minutely the changes occurring in the part, and their effects upon adjacent structures ; but to become successful or scientific practitioners it will be necessary to take a wider view of the subject. Pathology has certain laws, to which all tissues are liable, and the structures of the ear form no exception to this rule.* We may therefore say that the ear has no special pathological anatomy, or very little ; the special interest that attaches to the pathological changes occurring in it, is the effect which they produce upon the organ of hearing, and the relation which the diseased part bears to the surrounding structures. All this part of the subject has already been discussed ; what I now desire to do is to point out the analogies existing between the diseases of the tissues of the ear and those occurring in similar tissues elsewhere in the body, and thus to see from the broader stand-point the general laws or first principles which should always guide our diagnosis, prognosis, and treatment.

Let us, then, briefly proceed to trace these general principles in relation to the tissues forming the external ear. Here we find skin, subcutaneous cellular tissue, fat, a small amount of muscle, and yellow elastic fibro-cartilage, with some fibrous tissue-forming ligaments.

* See papers by the Author, " Medical Press and Circular," March, 1879.

These tissues we find affected exactly as in other parts ; thus, take the skin, erythema, eczema, psoriasis, pemphigus, lupus, ichthyosis, and purpura, may all affect the skin of the ear as they do that of other parts, and in each condition a constitutional or local cause must be looked for ; we should remember that erythema is often a manifestation of rheumatism, and seek for it accordingly in the patient, or, on the other hand, that it may be of reflex production, and due to disordered stomach or uterus. Eczema may be gouty, or due to local causes : thus the position and shape of the organ will suggest intertrigo, and its proximity to the scalp the possibility of a vegetable or animal parasite. Psoriasis, again, may be due to numerous constitutional causes, or be apparently a purely local disease ; while pemphigus and lupus will probably depend upon syphilis, and the ichthyosis have a congenital origin. Remembering the isolated position of the auricle and its exposure of a large surface for the radiation of its heat, we shall not be surprised to find it affected with gangrene, due either to impoverished blood, or enfeebled circulation and diseased vessels ; thus gangrene is common in feeble infants ; after typhus or other fevers ; in heart disease, or general atheromatous degeneration of the vessels ; or after frost-bite. The subcutaneous cellular tissue may become inflamed, either from injury, or the poison of erysipelas.

New growths found in the auricle will owe their origin to the tissues of which it is formed, and the analogues of these tissues in similar parts of the body will suggest the nature of the tumour. Thus the subcutaneous tissue will give rise to fatty and sebaceous tumours, and that part where it is most abundant, namely, the

back of the auricle and the lobule, will be the favourite sites of such new growths; fibrous thickenings, the result of the irritation of ear-rings, sometimes amounting to tumours, or even to the more dangerous keloid, also occur here; the latter is seen especially affecting the lobule in negresses.

Large *nævi*, like those common enough in the scalp, are occasionally found in the auricles.

Hæmatoma auris (*othæmatoma*) is a curious affection resulting from inflammation of the cartilages of the ear; the perichondrium is raised by the effusion of the products of inflammation, and there is much swelling of an inflammatory nature, combined with effusion of blood, in the cellular tissue of the concavity of the auricle, as well as below the perichondrium. The inflammation commonly subsides, and a cretaceous, or bony nodule, often results. It is frequently seen among the insane, but there is evidence that it is also of traumatic origin.

Passing inwards towards the external meatus, we must look for its diseases among those which affect similar parts of the body, namely, where skin is about to change to mucous membrane. Some of these are very characteristic; we see them on the lip, about the anus, and genital orifices. The diseases to which these parts are especially liable are epithelioma and condylomata. Epithelioma of the auricle is not unfrequent, and it takes origin more commonly from the central part in the immediate neighbourhood of the meatus than at the periphery; this distinguishes it in some measure from lupus, and perhaps from rodent ulcer, which may be regarded as a special form of epithelioma, having a clinical history and appearances peculiar to itself; both of these diseases may affect the auricle, but arise more frequently at its

periphery. The malformations of these parts I have dealt with elsewhere,* and they can scarcely be said to be the results of diseased action.

While studying the diseases of the external meatus, we shall, as usual, find a key to them in the anatomical structure of the part. It will be remembered that the outer half of the passage is formed by cartilage, the inner half by bone; the skin is thicker over the outer half, where it consists of both cuticular layer and corium, and contains hairs, follicles, and ceruminous glands; while the inner half is lined by skin, which consists only of a cuticular layer, the corium being blended with the periosteum of the bony walls of the tube. Upon this anatomical basis we may build up the pathological history of the part.

Von Tröltsch, as I have already stated (Chapter VI), pointed out that the common term "catarrh of the external meatus" has anatomically no justification whatever, "except, perhaps (as Schwartze says), in those cases in which the epidermis has been destroyed, as, for instance, in acute moist eczema." A discharge of pus from the external meatus nearly always proceeds from the middle ear, through perforation in the tympanum. The various forms of chronic suppurative inflammation of the external meatus may be grouped together under the name of *otitis externa*, but it is always desirable to seek as far as possible for their ultimate cause. The skin of the meatus may be affected by erythema, eczema, herpes, pemphigus, and erysipelas. The outer half of the canal is subject to an ordinary phlegmonous inflammation of the corium and subcutaneous cellular tissue, while the inner half, if inflamed, suffers from a periostitis, for its corium forms

* See page 52.

periosteum, and it has no subcutaneous tissue; caries or necrosis may result from this, if inflammation be severe.

Furuncles are common affections in this position; they are inflammations, commencing apparently in the follicles of the ceruminous glands; they occur, therefore, in the locality where these bodies are to be found, namely, in the anterior lower wall of the meatus. These inflammatory changes often lead to stricture of the meatus, and thus call for surgical interference; things, therefore, which would be of little importance elsewhere, as eczema, for instance, occurring here are frequently of the gravest moment, for chronic eczema induces hypertrophy of the corium and stenosis of the meatus (Schwartz).

Tumours, causing strictures of the canal, are not unfrequent, and take their origin from the anatomical elements. The ceruminous glands will produce, when obstructed, sebaceous tumours or cholesteatomata; the particular character of these I have already described, and need not further allude to. The cartilage forming the wall of the meatus gives rise to enchondroma; the bone at the inner end of the canal produces exostoses of two kinds, the inflammatory and non-inflammatory, which I have already described.* Sarcomata doubtless occasionally occur here, but little is known about them, and none have been recorded under that name. Indeed, it appears particularly noteworthy how little liable the external meatus is to malignant growths, especially when we consider the great amount of chronic irritation to which it is liable in many of its diseases—such as irritating discharges from the middle ear, chronic eczema, and the presence of inflamed ceruminous and sudoriferous glands, or of accumulations of hardened

* Page 57.

and irritating concretions of wax. Such irritations as these we have good evidence of as causes of malignant growths in other parts of the body, and I have strong suspicions that many of the so-called aural polypi which show such great proneness to recur, may, with great propriety, be ranked among the sarcomata. Among these we should probably find examples that might be classed as fibro-sarcoma, round-celled (or granulation) sarcoma, myxo-sarcoma, osteo-sarcoma, and osteo-chondromata.

The pathology of the *membrana tympani* appears at first sight complicated, but its anatomical structure is the key to all the changes to which it is liable. It consists of a layer of skin, chiefly composed of epithelium, with a very delicate and imperfect corium, a fibrous *membrana propria*, and a layer of mucous membrane. Each lamella has a pathology of its own, and every inflammation of the structure commences in only one layer, though it may eventually involve all. Thus the outer layer of skin is liable to eczema, pemphigus, and epithelial growths; it is also liable to idiopathic or traumatic inflammations, either acute or chronic, but these are rare. In acute inflammation of this layer the epithelium is raised up and subsequently destroyed by the swelling of the corium, due to exudation of leucocytes and proliferation of connective tissue cells. Its special appearances I have already described. It is evident that such changes as these will produce permanent thickenings and opacities of the membrane. Very frequently the inflammation involves all three lamellæ, and sometimes they produce ulceration and perforation, though this is rare. The middle or fibrous layer is especially liable to calcareous deposits, chiefly

urate of soda, occurring in gouty individuals ; sometimes to fatty deposits, and also occasionally to increased growth of connective tissue. Other calcareous deposits, the residue of bygone inflammations, are also found in the membrane. These, however, usually include all three layers ; they commence most commonly in the internal layer ; sometimes they are the results of inter-lamellar abscesses. A new growth of bone has been demonstrated in the neighbourhood of these old inflammatory calcareous deposits by Politzer and Wendt. The *membrana propria* having a deficient supply of blood-vessels, is the least liable of the three lamellæ to inflammatory changes. On the other hand, the internal or mucous layer for the opposite reason is, like other mucous membranes, especially liable to inflammatory changes. These we shall have to allude to more particularly when speaking of the mucous membrane lining the tympanum. The inflammation may be catarrhal, or of a more severe character, often producing perforation of the membrane. Minute tubercles occur in this membrane, in the submucous tissue, and are occasionally seen in acute tuberculosis ; they may thus lend an important aid to the diagnosis of an obscure medical case, just as we find in similar cases tubercles in the choroid, which will often clear up otherwise obscure symptoms. At present, observations of this nature have been so rarely made, that it is impossible to say with what degree of frequency they will be found, or whether they are more particularly associated with tubercular meningitis than with tubercle elsewhere ; the examination of the membrane is manifestly less painful to patients with meningitis than that of the retina ; while in many cases severe photophobia exists and entirely precludes

all possibility of observations on the latter; examination of the membrane for tubercle appears to me well worthy the attention of physicians. Inflammations of the internal layer often produce enormous thickenings of it, sometimes so much as to increase by five times its normal thickness.

Hæmorrhages not unfrequently occur in the membrane, as they do in other parts; these may take place in either the skin or mucous membrane, sometimes into both. They may be traumatic, or due to certain blood or vascular conditions, such as purpura in any of its forms, hæmorrhages from increased venous pressure, as in heart disease, bronchitis, or obstruction to the superior vena cava, innominate, or internal jugular veins. On the other hand, it may arise from increased arterial pressure, like the hæmorrhage in the retina or brain of Bright's disease. The hæmorrhage may be scanty or severe; it has sometimes a peculiar tendency to wander over the surface of the membrane; this characteristic locomotion has been described by Von Tröltsch. Otologists describe, in addition to these changes, certain abnormal appearances of the membrana tympani, which Schwartze, in his excellent handbook of the "Pathological Anatomy of the Ear,"* classes under the following headings:—1. Anomalies of colour and transparency, thickening, opacity, and calcification; 2. Anomalies of curvature; 3. Perforation and cicatricial formations; 4. Detachment of the membrane; 5. Abscess; 6. Ulceration; 7. Anomalies of the membrana flaccida Shrapneli. The etiology of most of these changes is sufficiently evident from the foregoing general observations on the pathology of the membrane. Some of its

* Recently translated by Orne Green.

appearances depend, however, on the condition of surrounding parts, more especially of the tympanum. The *colour* of the membrane varies considerably with the age of the patient; "the infantile drum-membrane on account of the greater thickness of its cutis and mucous layers, always appears of a thicker whitish grey than does the membrane of adults." In old age a yellowish or milky opacity is usually due, according to Grüber, to a fatty degeneration of the membrana propria. The pearl-gray colour of health may become deep gray, whitish gray, yellow, or yellowish red. The yellow and red colours being often due to the contents of the tympanum, yellow meaning pus, and red hyperæmia. The causes of opacity I have already indicated; they are usually due to inflammatory changes, and may consist of new growth of connective tissue in either lamella, of deposits of fat, lime salts, or of affections of the epithelium of either side; the production of calcareous and ossific deposits has also been alluded to. Flattening or increased convexity or concavity of the membrane have been described elsewhere; they are generally due to contraction or paralysis of the muscles acting on the drum, or to various conditions of the tympanum. Atrophy of the membrane may take place; it is usually divided into partial and total atrophy. The former is due to chronic inflammatory changes, the latter to tension from within, due to closure of Eustachian tube, or pressure from without, due to wax or tumours. Hernia of the membrane is described, produced by bulging of the mucous layer through a weakened and incomplete fibrous layer. Emphysema of the membrane is also occasionally produced by a collection of air beneath its cutis due to destruction of its mucous and fibrous layers.

Passing next to the tympanum itself, we may as usual reckon up its diseases in a similar manner, namely, by its anatomical structures. Chief amongst these is the mucous membrane, which lines it, next the bony walls, and, lastly, the small bones and muscles which it contains. The mucous membrane is liable to inflammations usually of a catarrhal kind, which are analogous with the changes seen in other mucous membranes. The most severe forms are those which are extensions of the inflammations occurring in the mucous membrane of the fauces and pharynx in diphtheria and scarlet fever; these pass along the Eustachian tube, and, affecting the tympanum with the same severity that they do the throat, often work terrible havoc there; for not only will they fill it with pus and produce perforation, by inflammation and over-distension of the drum-membrane, but frequently the deeper structures are also involved, so that the periosteum becomes injured and caries or necrosis of the bony walls ensue, producing in many cases an utter destruction of the organ, if not of the individual. I have already pointed out the extreme dangers which arise from inflammation of the tympanum on account of its immediate surroundings. These perils of meningitis, phlebitis, abscess of the brain, paralysis, or pyæmia, and the like, are all threatening when this most severe form of disease in the tympanum occurs. We may consider it fortunate sometimes when the cavity becomes blocked with a mass of cheesy material which may become quiescent; though unfortunately remaining as a hidden danger, which at any time may develop into an active centre of infection, and cause a general tuberculosis. This form of disease is most frequently seen in young children, and it often affects both

ears at once ; when this happens, they generally grow up as deaf mutes. I have already referred to one case (27) in which this happened, and which resulted in the manner just described.

In the ordinary and less severe forms of catarrhal inflammation the mucous membrane of the tympanum resembles all other mucous membranes. The cause may be constitutional or local. Gout and Bright's disease are both alike known to produce mucous catarrh ; no part escapes from them. Gouty bronchitis or gastrointestinal catarrh are well known to every practitioner, so also are gouty conjunctivitis (though scleratitis is more common), urethritis, and vaginitis ; the same is true of Bright's disease, and both conditions affect the tympanum as they do other mucous membranes. Tubercle is another constitutional disease which affects mucous surfaces, and it appears probable that this one suffers like the rest. Tubercles have not been found after death and identified as such in man, but Schütz has found them in the pig, and Schwartze believes that he has seen them on the drum-membrane during life. Syphilis, as far as we know, does not attack mucous surfaces, nor is it often found in the ear, except when it commences in the auricle and passes inwards along the external meatus (as in the cases I have described, p. 67) or in the Eustachian tube and travels outwards to the middle ear.

In early life most tympanic catarrhs are strumous, if we exclude those following fevers, and being strumous take their origin I believe in tubercle, which I cannot but think must be regarded as the primary cause of all strumous inflammations ; while I regard tubercle, however, as commonly a local and frequently non-infectious

disease, although having a constitutional origin, yet I cannot but think that in some cases it does become infective and spreads rapidly, by means of the lymphatics, from one centre, first to the neighbouring parts, and subsequently perhaps throughout the body. It is I believe because of this tuberculous or strumous nature of the disease that the results produced by it in children and young adults are so severe. Many of those cases, commonly classed as "purulent catarrh," are I believe of this character, and little but general constitutional treatment will effectually relieve such cases, although local treatment is of course also most necessary to guard against the special local dangers, such as blocking of the Eustachian tube, over-distension of the cavity, adhesions of the drum-membrane to the walls, ankylosis of the ossicles, formation of polypi, and extensive caries or necrosis of the walls.

Other cases of a less severe nature in young people and most cases in adults, including those due to gout and Bright's disease, resemble the ordinary catarrhs of the Schneiderian membrane or of the bronchi, but are more chronic. When they are acute and severe they produce in their first stage a considerable swelling of the mucous membrane with arrest of secretion; subsequently secretion becomes profuse and often muco-purulent; as in other parts the mucus may contain more or less pus, according to the severity of the affection and the duration of the disease. If this condition persists for a long period, as it is very apt to do, serious consequences to the organ ensue. The cavity it must be remembered is a small one; a little swelling brings parts into contact, and adhesions result. Little strings or bands of organised lymph are seen very frequently stretching across the

cavity. The swelling of the sub-epithelial connective tissue may be very severe, and being produced in large measure by exudation cells or proliferated connective tissue corpuscles, very considerable thickening may result from it. As the membrane surrounds the ossicles these delicate little structures may have their movement very greatly embarrassed. The labyrinthine fenestræ may be partially or completely closed by the swelling; if the catarrh be very severe, resulting in a highly purulent discharge, the drum-membrane may be softened and perforated, though these perforations, if resulting from simple catarrh, usually heal rapidly. Most modern writers, including Schwartze, divide the catarrhal inflammations of the tympani mucous membrane into-- (1) serous catarrh; (2) mucous catarrh; and, (3) purulent catarrh. I cannot, however, agree with these divisions. The term "serous" catarrh is confessedly employed to denote an inflammation akin to that occurring in a serous membrane, and therefore conveys a false idea of its pathology; while the "purulent" catarrh is made to include two distinct diseases, one of them in no sense a catarrh. A catarrhal inflammation essentially consists of one not producing destruction of tissue, or at least of no tissue below the epithelial layer; and to this I would limit it, except for some few slightly deeper, but still superficial erosions of the surface and destruction of mucous membrane; but when more severe than this the changes belong to another type, and, as I believe, are generally tubercular, it is therefore eminently necessary to distinguish between them and simple catarrhs.

Now a catarrhal inflammation of a mucous membrane in any part may result in the exudation of clear

serous fluid, of mucous, muco-pus, or pus, together often with a little blood, and occasionally when exceptionally severe, with some highly corpuscular lymph. Now all these products are found in the tympanum when affected with catarrh; and although it may be desirable to indicate by the name the nature of the fluid effused, nevertheless it is necessary to remember that they are only slight modifications of the same disease, although they may require somewhat different treatment.* In some cases the effusion from the tubular and racemose glands of the mucous membrane is a weeping of a clear serous fluid containing but little mucin. The catarrh is chiefly glandular, and produces but little thickening of the membrane; in others the glands secrete a viscid, thick, tenacious mucus, which adheres firmly to the walls of the cavity and causes great inconvenience; at other times it is chiefly pus, mingled more or less with mucus. It is accompanied, as I have said, with much swelling of the walls; the whole membrane is involved, and the results are often severe and sometimes permanent. The changes thus produced are those described by all the leading authors on the ear, including Morgagni, Von Tröltsch, Toynbee, Politzer, Grüber, Wendt, and more recently by Schwartze, as "adhesive inflammation" and "sclerosis," and a parallel is drawn between the tympanic mucous membrane and *serous* membranes in this tendency to *adhesive inflammation*. But surely the pathology of the adhesions formed in the tympanum and those in serous membranes is altogether different. As I have remarked, adhesions and bands are common in the tympanum, but they result, I believe, in many cases from the

* See also page 72.

tubercular or strumous form of inflammation, in others from the swelling which takes place producing contact between the opposite sides, sometimes perhaps from organised blood-clots. I cannot believe that fibrinous lymph is *commonly* effused from a mucous surface. It must be remembered in judging of the results of catarrhal inflammation in the tympanum, that stagnation of fluids and contiguity of walls render its circumstances peculiar and probably its results eccentric.

Another source of difficulty in dealing with the pathology of the tympanum is that the lowest layer of the mucous membrane becomes also the periosteum of the bone; hence it follows that a severe catarrh may penetrate sufficiently deeply to produce an inflammation of bone. This may be either an acute periostitis, leading to necrosis, or it may produce a chronic periostitis, inducing hypertrophy and irregularity of the bone, which may either be general throughout the whole tympanum, or localised to a part; sometimes only the ossicles are thus affected, indeed they more frequently suffer in this manner than any other part, for the mucous membrane covering them is thinner than elsewhere, and a less severe inflammation is required to produce irritation and proliferation of the osteoblastic layer: in this way the ossicles readily become ankylosed to one another, or to the part to which they are attached; the stapes is thus frequently fixed to the foramen ovale of the vestibule. This condition when general is called bony sclerosis (Von Tröltsch) of the tympanum; sometimes it is called hyperostosis. If the primary catarrh be less severe, only the sub-epithelial layer becomes affected; this becomes greatly thickened and fibrillated; it presents a stiff and leathery appearance, described by Toynbee; occasionally

the deep periosteal layer is similarly affected by *connective-tissue sclerosis*.

In old persons, especially those suffering from osteoarthritis, a similar change in the ossicles and their articulations to that seen in other joints, has been described. Their cartilages have been eroded, and the articulating surfaces thickened and ankylosed.

Polypi frequently occur in the middle ear, and are, perhaps, invariably the results of inflammation. Their structure and history vary with the severity of the inflammation and the parts from which they spring. The most common is the ordinary mucous polypus of a similar nature to those seen in the nose and uterus. These spring from the mucous surface, are formed of soft cellular tissue ; they contain induplications of the epithelial surface, forming gland-like tubes or sacs. The surface of the growth is covered with ciliated cylinder epithelium, which changes sometimes at its extremity to a mixed or pavement epithelium. More rare are the fibromata developed from the periosteal layer. " Their structure consists of a firm connective tissue, with numerous spindle- or star-shaped connective tissue corpuscles, the processes of which anastomose with each other " (Schwartz). Myxomata are considered by the author just quoted extremely rare ; with this my own experience does not quite agree. Certainly a far more common form of polypus is the exostosis, which from its nature, origin, and shape may fairly be classed among these growths : these always result from inflammation of the periosteum and bone, and are generally pedunculated. On the distinction between these structures and the ivory-like tissue of the hyperostosis I have already insisted.

In addition to the polypi of the tympanum other new

growths occasionally exist, such as cholesteatoma, retention, sebaceous and dermoid cysts, osteosarcoma, and epithelial cancer.

The mastoid cells are closely allied to the tympanic cavity in their diseases, but they are more liable to caries of their bony walls. The reason for this is sufficiently evident when we consider that they are lined with extensions of the mucous membrane of the tympanum, but this mucous membrane is not ciliated; a catarrh of the tympanum always extends into these cells, but there is deficient outlet for the effused inflammatory products, which are no longer wafted onwards by the ciliary currents; it is like lobular pneumonia occurring in a lung; the cellular material once effused or proliferated is got rid of with great difficulty; it tends to caseate and often to produce caries of the surrounding or intercellular bony walls. If the inflammation is more severe, or of a *croupous* nature, it may produce rapid necrosis of the bone. Primary inflammation of the mastoid cells is rare; on the other hand, primary inflammation of the external periosteum is not uncommon; these frequently lead to subcutaneous abscesses beneath the periosteum, which I have already described; the early treatment of this condition is most important and necessary for the safety of the patient. This periostitis on the external surface of the mastoid is frequently secondary to primary disease of the middle ear; sometimes, however, no reason can be assigned for its occurrence. In all cases of disease about the mastoid it is well to remember its close proximity to the lateral sinus; plugging of this vessel from phlebitis and death may result from extension of the inflammation from the bone to it.

The Eustachian tube forms a connecting link, both

anatomically and pathologically, between the throat and the tympanum. Its diseases are chiefly limited to its mucous membrane, which may suffer from acute or chronic catarrh, the result of which may be an exudation of glairy, inspissated, or purulent mucus. It may undergo thickenings or contractions throughout its whole length, or at various parts. The causes of its most intense inflammation are certain fevers, namely, scarlatina, variola, and diphtheria; less severe acute or subacute inflammations result from catarrh, arising from cold, gouty catarrh, catarrh from irritation of the alimentary canal, or from local hyperæmia, the results of smoking, and perhaps of alcoholic excess. The ulcerations of the Eustachian tube are interesting; they are chiefly such as affect the throat; namely, syphilitic, tubercular, follicular, diphtheritic, and variolous; these are nearly all confined to the region of its mouth in the pharynx; nearer the tympanum ulcerations are chiefly secondary to caries of the temporal bone or epithelial cancer. Polypi have sometimes been met with in the tube.

The diseases of the labyrinth are more commonly functional than structural. They depend in great measure, as I have already indicated, on vascular conditions, such as anæmia, hyperæmia, high or low arterial pressure, and sometimes hæmorrhages; the causation and effects of these have been previously dwelt upon. Occasionally inflammation extends into it from the tympanum; the result may be a serous or purulent exudation, or sometimes a sclerosis. Suppurative inflammation may result in a blocking of the labyrinth with caseous material, or in caries, or sometimes necrosis. Chronic and less severe inflammatory changes may affect

the soft structures, and produce thickening, atrophy, or fatty degeneration of the membranous labyrinth, of the organ of Corti, or of the ultimate nerve endings. It is doubtful whether the variations in size of the otoliths and lime crystals are pathological or not.

The auditory nerve itself is especially liable to diseases caries of the petrous bone, or meningitis, occasionally produce neuritis. Atrophy is described as the result of many brain lesions; or of locomotor ataxy; tumours of brain, meninges, or petrous bone; hæmorrhage or periostitis in its bony canal; and also, according to some observers, of long-continued arrest of function. Numerous new growths have been found involving the sheath of this nerve, including fibromata, neuromata, sarcomata, and gummata. Many other minor conditions of the labyrinth and of the auditory nerve have been described, and many remain to be discovered, but I have not tried to give an account in this chapter of the special pathology of the ear, I have rather endeavoured to indicate the application of the general laws of pathology to the diseases of this organ, for I feel assured that such considerations will prove our safest guides to correct diagnosis and to successful treatment.

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